









BULLETIN  
OF THE  
AMERICAN MUSEUM OF NATURAL  
HISTORY.

---

*Volume XX, 1904.*

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NEW YORK.

PUBLISHED BY ORDER OF THE TRUSTEES.

FOR SALE BY

G. P. PUTNAM'S SONS, NEW YORK AND LONDON;

J. B. BAILLIÈRE ET FILS, PARIS;

R. FRIEDLÄNDER & SOHN, BERLIN;

AND AT THE MUSEUM.

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1904.



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## DATES OF PUBLICATION OF AUTHORS' SEPARATES.

The edition of authors' separates is 200, of which about 70 are mailed on the date of issue, and the others placed on sale in the Library.

Art. I, Jan. 14, 1904.	Art. XX, June 29, 1904.
" II, Feb. 10, 1904.	" XXI, July 1, 1904.
" III, " 17, 1904.	" XXII, " 20, 1904.
" IV, " 29, 1904.	" XXIII, Aug. 2, 1904.
" V, March 12, 1904.	" XXIV, Sept. 8, 1904.
" VI, " 12, 1904.	" XXV, " 8, 1904.
" VII, " 31, 1904.	" XXVI, " 8, 1904.
" VIII, April 7, 1904.	" XXVII, " 24, 1904.
" IX, " 7, 1904.	" XXVIII, Oct. 8, 1904.
" X, " 23, 1904.	" XXIX, " 8, 1904.
" XI, " 25, 1904.	" XXX, " 11, 1904.
" XII, May 10, 1904.	" XXXI, " 15, 1904.
" XIII, " 28, 1904.	" XXXII, " 15, 1904.
" XIV, " 28, 1904.	" XXXIII, " 29, 1904.
" XV, " 28, 1904.	" XXXIV, Nov. 4, 1904.
" XVI, " 28, 1904.	" XXXV, " 28, 1904.
" XVII, " 28, 1904.	" XXXVI, Dec. —
" XVIII, June 2, 1904.	" XXXVII, " —
" XIX, " 16, 1904.	" XXXVIII, " —, 1904.

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<sup>1</sup> Printed *cauræ* by typographical error.



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## ERRATA.

Page 210, line 8 from bottom, for *Urocyon cineroargenteus* read *Urocyon cinereoargenteus*.

Page 234, center heading, for *cauræ* read *caucæ*.

Page 319, center heading, for *Teleceras* read *Teleoceras*.

Page 392, line 16 from bottom, for *M. bivittata straminea* read *M. straminea*.



# BULLETIN

OF THE

## AMERICAN MUSEUM OF NATURAL HISTORY.

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VOLUME XX, 1904.

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### Article I. — THREE NEW GENERA OF INQUILINE ANTS FROM UTAH AND COLORADO.

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PLATES I AND II.

The three genera of ants described in this paper are, for the following reasons, of more than usual interest to the myrmecologist: First, because they live with other ants; second, because in one of the genera, *Symmyrmica*, the males are of the ergatoid type, *i. e.*, wingless and like the worker in the structure of the thorax; while in the two other genera, *Sympheidole* and *Epipheidole*, the worker caste has disappeared, so that these species are no longer trimorphic. Hitherto only a single American ant (*Ponera ergatandria*)<sup>1</sup> has been found to have worker-like males, though these are known to occur in four European species: *Formicoxenus nitidulus*, *Anergates atratulus* (both inquilines), *Ponera punctatissima*, and *Cardiocondyla stambuloffii*. And only two genera, *Anergates* of Europe and *Epæcus* of the United States, have been described as lacking the worker caste. Third, the three new genera present some interesting taxonomic difficulties. *Symmyrmica* is obviously allied to the European *Formicoxenus*, but differs in the character of its males, which are not nearly so ergatoid,

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<sup>1</sup> This species, originally described by Forel from the island of St. Vincent, W. I., occurs also in the Southern States. I have taken it at the sources of the Comal River, near New Braunfels, Texas. In the very same locality occur two other tropical ants, not hitherto included in the North American fauna, namely, *Cyphomyrmex rimosus* and *Strumigenys margaritæ*. The latter was also originally described from St. Vincent by Forel.

but seem to have been arrested in a less degenerate condition. In other words, the antennæ, head, and thorax of the male *Symmyrmica* are much more like those of the typical winged Myrmicine male and less like those of the worker than are these structures in the ergatoid male of *Formicoxenus*. Moreover, in all three phases, the sculpture and pilosity of the head, thorax, and pedicel, and the absence of a spine on the ventral surface of the postpetiole, give the American form a distinctive habitus.<sup>1</sup> The determination of the systematic position of *Epipheidole* and *Sympheidole* is even more difficult, owing to the absence of the workers, on which generic and specific distinctions among ants are chiefly based. Although these ants are certainly very closely related to *Pheidole*, at least so far as the males are concerned, they cannot properly be assigned to this huge genus, if, as I believe, the worker caste is really absent. Nor can we properly place in a single genus two such different ants as the females of *Sympheidole* and *Epipheidole*. Fourth, the occurrence of a genus like *Symmyrmica* in North America is interesting from the standpoint of geographical distribution, since this genus is related both in its structure and instincts to the European *Formicoxenus*. This relationship still further emphasizes the homogeneous character of the circumpolar ant-fauna. Fifth, it is interesting to note that dealated females of *Epipheidole* and *Sympheidole* have been known for some time, but have been regarded as peculiar dwarf females (microgynes) of the species of *Pheidole* with which they live. Referring to some specimens of *Pheidole pilifera* from Nebraska, Emery<sup>2</sup> says (p. 290): "Mit diesen Soldaten und einigen Arbeitern sandte mir Herr Pergande ein flügelloses, aber geflügelt gewesenes Zwergweibchen von kaum  $3\frac{1}{8}$  mm., mit wenig entwickeltem Thorax und dicken, stumpfen, beulenartigen Metanotumdornen." There can be little doubt that this insect was a female of the *Epiphei-*

<sup>1</sup> Although three European species of *Formicoxenus* have been described (*F. nitidulus* Nyl., *corsicus* Emery and *ravouxi* André) the two latter are known only from single female specimens. And it is not even certain that these should be placed in the genus *Formicoxenus*, since they have no prominent spine on the ventral surface of the postpetiole. When their workers are discovered it may, perhaps, be necessary to redefine the genus and to reduce *Symmyrmica* to the rank of a subgenus.

<sup>2</sup> Beiträge zur Kenntnis der nordamerikanischen Ameisenfauna. Zool. Jahrb., Abth. f. Syst., Bd. VIII, 1894, pp. 257-360, Taf. VIII.

*dole inquilina* described below as occurring with *Pheidole pilifera* var. *coloradensis*. Among a number of carded soldiers and workers of *Pheidole ceres* sp. nov. sent me from Boulder, Colo., by Father J. Schmitt, O.S.B., a few years ago, there is a single small dealated female which agrees perfectly with one I took with a number of small males in a nest of the same species of *Pheidole* in the Ute Pass during the past summer. Before I had found this colony and while I still believed Emery's interpretation to be correct, I requested a former pupil, Miss Margaret Holliday, to describe and figure the small female received from Father Schmitt and described below under the name *Sympheidole elecebra*, as a peculiar microgyne of *Pheidole ceres*. It is certainly true that in many respects the female *Sympheidole* closely resembles the female of *Ph. ceres*, just as the female of *Epipheidole* resembles the same sex of *Ph. pilifera*, but I believe, nevertheless, that we are compelled to regard the two small females as belonging to distinct species and even genera, since the corresponding diminutive males have been discovered. We need not be disconcerted by the resemblances in form and sculpture between the inquiline ants and their hosts. Such resemblances are well known in other cases,<sup>1</sup> and are probably due to mimicry; *i. e.*, they serve to facilitate symbiosis by deceiving the tactile sense of the host ant. This kind of mimicry reaches its most remarkable development in certain myrmecophilous beetles that live with ants of the genera *Dorylus* and *Eciton*.<sup>2</sup>

### **Symmyrmica** gen. nov.

Allied to *Formicoxenus*. Male, female, and worker all of about the same size. Body long and slender, opaque, with the exception of the gaster and legs, and abundantly pilose. Hairs robust, frayed at their ends into several acute microscopic processes. There is no spine on the ventral surface of the postpetiole.

*Worker*. — Head longer than broad, subopaque, slightly wider in front than behind, anterior and posterior corners rounded, occipital

<sup>1</sup> Confer *e. g.* the resemblances between the following inquiline ants and their hosts: *Tomognathus* and *Leptiothorax*; *Leptiothorax emersoni* and *Myrmica brevinodis*; *Strongylognathus* and *Tetramorium*; *Symmyrmica* and *Myrmica mutica*; *Polyergus* and *Formica*, etc.

<sup>2</sup> See *e. g.* E. Wasmann: Neue Dorylinengäste aus dem neotropischen und dem äthiopischen Faunengebiet. Zool. Jahrb., Abth. f. Syst., Bd. 14, Heft 3, 1900, pp. 1-75, Taf. I, II.

border straight, sides subparallel. Eyes moderate, flattened, in the middle of the lateral surface. Small ocelli often present. Mandibles 6-toothed, two apical teeth longest, four basal teeth conical, distinct. Clypeus large, convex, but longitudinally impressed in the middle, anterior border broadly rounded, entire; posterior portion somewhat retuse, extending back between the antennal insertions as far as their posterior edges. Frontal area indistinct, impressed. Antennal foveae large. Frontal carinae prominent, decidedly longer than in *Formicoxenus*, subparallel, separated by somewhat over a third the breadth of the head. Maxillary palpi 5-jointed (instead of 4-jointed as in *Formicoxenus*); labial palpi 3-jointed. Antennae like those of *Formicoxenus*, 11-jointed; scape rather short, nearly as long as the first nine joints of the funiculus; first funicular joint as long as joints 2-4 together; joints 2-6 distinctly broader than long; three terminal joints robust, forming a distinct club; last joint as long as the two preceding together. Thorax long and slender, narrower than the head, broadest through the pronotal region, humeri rounded; in profile the dorsoventral diameter is nearly the same through the pro- and epinotal regions. Promesonotal surface broadly convex, promesonotal suture faint; mesoepinotal constriction broad and pronounced. Epinotum armed with short spines, its basal surface convex, its declivity shorter, concave. Petiole and postpetiole as in some species of *Leptothorax*, the former not pedunculate, produced ventrally into a blunt, flattened tooth, the latter quite unarmed below. Gaster large, about twice as broad as the thorax, elongate elliptical, compressed dorso-ventrally, with sloping anterior angles. Sting slender but well developed. Legs robust, femora fusiform, middle and hind tibiae spurless.

*Female.* — Resembling the worker except for the usual female Myrmicine characters. Eyes and ocelli but little larger than in the worker, thorax higher and somewhat broader, with the various sclerites distinctly marked. The type is dealated so that the nature of the wing venation cannot be ascertained.

*Male.* — Ergatoid, wingless. Head, excluding the eyes, but little longer than broad, rounded in front and behind, cheeks very short. Eyes and ocelli very large and prominent. Mandibles small, far from meeting each other, their blades with a single median, acute tooth. Clypeus short and very convex, anterior border nearly straight, somewhat retuse, posterior border ending in front of the antennal insertions. Frontal area large, triangular, impressed. Frontal carinae very short. Maxillary palpi 5-, labial palpi 3-jointed. Antennae long and slender, 12-jointed, all the joints much longer than broad; scape shorter than in the worker, about as long as joints 1-4 of the funiculus; joints 1-7 of the latter subequal, four terminal joints longer, not forming a club as in *Formicoxenus*; last joint somewhat shorter than the two preceding taken together. Thorax resembling that of the worker but

broad, higher and less constricted in the mesoëpinotal region. Mesonotum, paraptera, scutellum, and metanotum all distinct, but small. There are even traces of the Mayrian furrows on the mesonotum. Epinotal spines of worker replaced by rather obtuse swellings. Petiole, postpetiole and gaster like the corresponding parts of the worker, except that the petiolar node is lower and rounder and the gaster has five instead of four visible segments. External genital valves exerted, rounded at their tips, concealing the well-developed median and internal appendages and penis; cerci small and slender. Legs longer and more slender, femora less swollen in the middle than in the worker.

***Symmyrmica chamberlini* sp. nov.**

*Worker* (Figs. 3, 4, 5, and 7). — Length 3–3.25 mm.

Antennal scape reaching to half-way between the eye and the posterior corner of the head. Epinotal spines short and acute, hardly longer than broad at their bases, shorter than the distance which separates them, directed upward and backward. Petiole from above oblong, with subparallel sides, about  $1\frac{1}{2}$  times as long as broad; node in profile rather conical, transverse, but not very high, both its anterior and posterior slopes concave, the former somewhat longer than the latter; lower surface with a median keel ending anteriorly in a blunt tooth. Postpetiole half as broad again as the petiole, distinctly broader than long, with rounded anterior angles, constricted behind at its juncture with the gaster; in profile evenly convex on the dorsal, somewhat flattened on the ventral surface.

Mandibles, head, thorax, petiole, and postpetiole opaque. Clypeus, frontal area, gaster, and legs shining. Mandibles coarsely punctate. Clypeus longitudinally rugose except in the middle; this and the interrugal spaces with shallow punctures. Head rather coarsely and densely, longitudinally reticulate-rugose, with punctate-rugose interrugal spaces. Thorax reticulate-rugose, very finely and irregularly on the pro- and mesonotum, much more coarsely on the pleuræ and epinotum. As in the head, the coarser rugæ enclose minor reticulations. Petiole and postpetiole uniformly rugose-punctate. Antennæ and legs covered with coarse, piligerous punctures.

Excepting the lower surfaces of the thorax and pedicel, the body as well as the legs and antennæ are covered with abundant, coarse, suberect, yellow hairs, which are longest on the body, especially on the pedicel and gaster, and shorter and somewhat more reclinate on the appendages. There is no pubescence.

Rich ferruginous red throughout, gaster and legs somewhat paler than the head, thorax, and pedicel.

*Female* (deålated). — Length 3.25 mm.

Differing from the worker in the sculpture of the thorax: the meso-

notum, paraptera, and scutellum being subopaque and rather finely, longitudinally rugose, the mesonotum smooth in the parapsidal and midanterior regions, which are also of a paler color than the remainder of the thorax. Prothorax, pleuræ, and epinotum very coarsely reticulate-rugose. Epinotal spines of about the same size and shape as in the worker.

*Male.* (Figs. 1, 2, and 6.)—Length 3–3.25 mm.

Epinotal spines reduced to two obtuse swellings. Petiole nearly twice as long as broad, the anterior portion, seen from above, somewhat more slender than in the worker, without a ventral tooth, and with the node rounder and lower.

Sculpture, pilosity, and color like those of the worker, with the following exceptions: Scutellum and parapsidal regions of mesonotum smooth and shining; bottom of mesoëpinotal constriction with several prominent longitudinal rugæ; upper surface of postpetiole smoother, and upper surface of epinotum finely reticulate-rugose like the pedicel. Legs with somewhat sparser hairs. Head darker than the remainder of the body; ocellar region black. The cephalic rugæ are denser and sharper around the ocelli, from which they tend to radiate.

Described from twenty-one workers, five males, and a single female taken Aug. 20, 1902, near Salt Lake City, Utah, in a flourishing colony of *Myrmica mutica* Emery by Mr. C. V. Chamberlin. In thirteen of the workers minute ocelli are present, although sometimes only the anterior median ocellus is represented. As there were many fine males and virgin females of the *Myrmica* in the nest, it is probable that the habits of *Symmyrmica chamberlini* are similar to those of the European *Formicoxenus nitidulus* and the American *Leptothorax emersoni*. The *Symmyrmica* probably have their own independent nest in the midst of the *Myrmica* formicary, but consort freely with the host ants. Confirmation of this view is contained in the following notes kindly sent me by Mr. Chamberlin: "Nests of *Myrmica mutica* are common in some localities near Salt Lake City over the flood-plains of the Jordan River. The soil where they occur oftenest is pre-vaillingly argillaceous and sometimes contains much 'alkali.' I have not found them in stony or gravelly ground. All the nests observed opened free from any cover, and not a few were seen in the middle of foot-paths, although they prefer loose soil. In several parts of a ten-acre field where the soil is of



the usual character I found nests of this *Myrmica* containing the symbiotic species. Three of these compound colonies were preserved, two now being in a collection stored at my home in Utah, the other being the one you have examined. I never succeeded in finding one of the compound nests elsewhere than in this particular field. My attention was drawn to the first compound nest by seeing two individuals of *Symmyrmica* disappear into a burrow immediately following a *Myrmica* worker. Upon excavating I found others of the symbiotic form, mostly collected in a chamber about eight inches below the surface of the ground. The nest seemed to be above the average in size."

About Colorado Springs, Colo., the nests of *Myrmica mutica* are of common, though sporadic occurrence. I have found them only in the loose silt and fine gravel of creek bottoms, especially along Monument Creek, Cheyenne Creek, and the tributaries of the Fontaine qui Bouille. Though I dug up many of the nests I was not fortunate enough to find the *Symmyrmica* in any of these localities.

### **Sympheidole** gen. nov.

Small species allied to *Pheidole*. Workers apparently nonexistent; male and female about the same size, both winged.

*Female*. — Head, excluding mandibles, as broad as long, as broad in front as behind; anterior and posterior angles rounded, posterior border straight, sides rather convex. Eyes rather large, protruding, distinctly in front of the middle of the head, cheeks short. Ocelli of moderate size, rather far apart. Mandibles convex, with two strong apical teeth, of which the terminal is the longer; remainder of blade sharp, toothless. Clypeus moderate, convex behind, extending back between the antennal insertions; anterior border retuse, distinctly impressed in the middle. Frontal area distinct, subelliptical, concave. Antennæ 12-jointed; scape rather long, funiculus with long and robust first joint; three terminal joints forming a distinct club. Frontal carinæ short, rather far apart, diverging behind. Thorax of the typical Myrmicine type, but rather small, resembling that of *Pheidole*; mesonotum convex in front, flattened behind, not as broad as the head through the eyes. Epinotum armed with short spines. Petiole with a short peduncle and shaped like that of *Pheidole*, but with a much lower and rounder node, without a tooth on the anterior ventral surface. Postpetiole very broad and short, with prominent posterior

angles; nearly as broad as the first gastric segment, which has a very straight anterior border and rather prominent anterior angles. This first segment forms nearly  $\frac{2}{3}$  of the gaster, which is elliptical and dorsoventrally flattened, but not more convex on the ventral than on the dorsal side. Legs rather slender, femora fusiform, somewhat incrassated in the middle, tibiae somewhat enlarged towards their distal ends. Strigil well developed, middle and hind tibiae spurless. Wings absent in the types. Body, legs and antennae covered with coarse hairs, which are microscopically frayed at their ends.

*Male.* — Very similar to the male of *Pheidole*. Head, excluding the eyes, as broad as long, cheeks extremely short, postocular borders long, converging behind, occipital border straight. Eyes and ocelli very large, protruding. Mandibles slender, with very acute tips and rounded edentulous borders. Maxillary palpi 3-, labial palpi 2-jointed. Clypeus convex, broadly rounded in front, anterior margin entire. Antennae long and filiform, 13-jointed; scape short, first funicular joint large and globose, remaining joints long and cylindrical. Thorax robust, broad through the alar insertions; mesonotum without Mayrian furrows; epinotum rounded, unarmed. Petiole like that of the female; postpetiole broad, with a prominent spine-like process on either side. Gaster as in *Pheidole*; genitalia prominent, tips of outer valvules broadly rounded, mesial surfaces concave; median and inner valvules robust, unciform, the latter with more acute, the former with more broadly rounded tips. Legs very long and slender, femora and tibiae not incrassated; last tarsal joint of all the legs somewhat dilated. Wings like those of *Pheidole*, with complete discal and two cubital cells. The second cubital cell is small and triangular. In some specimens the recurrent vein is obsolescent, so that the discal cell may be open. Apterostigma large. Hairs on the body and legs tapering, not microscopically frayed at their ends.

### *Sympheidole elecebra* sp. nov.

*Female* (deālated).—(Fig. 8.) Length 2.75–3 mm.

Antennal scape reaching to the posterior corner of the head; first funicular joint nearly as long as the four succeeding joints taken together; joints 2–6 subequal, the second joint as long as broad, joints 3–6 broader than long; seventh joint nearly twice as long as wide, broader than the preceding joints; terminal joint of club tapering, as long as the two preceding, subequal joints together. Epinotal spines small and acute, as long as broad at their bases, directed backward and outward and somewhat upward, farther apart than broad at their bases. Petiole from above  $1\frac{1}{2}$  times as long as broad, decidedly broader behind than in front, node transverse, rounded, rather low, in profile, with long, rather straight anterior, and abrupt, rounded posterior slope. Postpetiole three times as broad as the petiole,

about  $\frac{1}{4}$  as long as broad, its anterior border straight in the middle with convex sides, its posterior border with concave sides, so that the segment presents two pointed, somewhat backwardly directed, posterior angles.

Smooth and shining. Mandibles subopaque, coarsely and sparsely punctate towards their tips, striated at their bases. Head with scattered piligerous punctures and a few longitudinal rugæ on the cheeks and between the frontal carinæ on either side of the frontal area. Pro- and mesonotum and scutellum with scattered piligerous punctures; epinotum subopaque, finely punctate-rugose. Petiole and postpetiole punctate and subopaque on the sides and below, smooth and shining above. Gaster with scattered piligerous punctures.

Whole insect, including mandibles, antennæ, and legs, covered with abundant and rather long, reclinate, yellowish hairs, which under a low magnification appear obtuse, but are microscopically frayed at their ends into several short, acute processes.

Rich reddish brown, the head darker, in one of the specimens black; the paraptera, legs, and funiculi more yellowish.

*Male.* (Figs. 9, 10, and 11.)—Length 2.5–2.75 mm.

Antennal scape as long as the first and second joints of the funiculus taken together; first funicular joint hardly longer than broad; joints 2–11 subequal, slightly increasing in length to the terminal joint, which is twice as long as the one preceding. Petiole about twice as long as broad, narrower than in the female and less widened behind, with a lower, more rounded node. Postpetiole three times as broad as long, shaped somewhat like the postpetiole of the female, except that the acute lateral angles are at, instead of behind, its median transverse diameter.

Head opaque, somewhat more shining behind, its surface uneven, densely punctate. Thorax, pedicel, and gaster shining, indistinctly and sparsely punctate.

Covered with rather long, sparse, and reclinate, yellowish hairs, which taper at their ends.

Head black; thorax, pedicel, and gaster piceous brown, darker on the dorsal surface. Mouth parts, antennæ, venter, genitalia, and legs, sordid yellow, coxæ, femora, and tibiæ infuscated except at the articulations, which are paler. Wings grayish hyaline with sordid yellow veins and distinct brown apterostigma.

Described from two females and eighteen males. Father J. Schmitt, O.S.B., sent me one of the former together with numerous soldiers and workers of *Pheidole ceres* sp. nov., collected near Boulder, Colo. The other female and the males were taken in the Ute Pass, near Manitou, Colo., by myself,

Aug. 17, 1903, also in a *Pheidole ceres* nest. This nest was completely excavated and carefully examined, but was found to contain only soldiers and workers of the *Pheidole* and, besides the adult forms, several pupæ of *Sympheidole* males. No workers belonging to the latter species could be detected, though from what we know of other ants, they should certainly have been present, if they exist at all, in the nest at the time of maturity of the males. When the nest, which was under a large stone, was disturbed, the *Pheidole* workers hurriedly seized the inquiline and their pupæ and carried them into the galleries. There could be no doubt concerning the fact that the two species formed a mixed colony and were living on perfectly amicable terms with each other. The absence of any *Pheidole ceres* queens, of which there are normally from one to five in a colony, would seem to indicate that, like the European *Anergates*, the American *Sympheidole* does not permit the sexual forms of its host to mature.

As the host ant of this interesting inquiline is still unknown to science, I here insert a description of all four of its phases:

### ***Pheidole ceres* sp. nov.**

*Soldier*. — Length 3–3.25 mm.

Head large, excluding the mandibles but little longer than broad, sides subparallel, posterior corners prominent, rounded, occipital border rather deeply excised and with a pronounced median, vertical groove growing much shallower in front of the crown, which is convex. The head is thickest dorsoventrally through its anterior portion. Eyes distinctly in front of the middle of the sides, of moderate size, flattened. Mandibles convex, toothless, with rounded tips and somewhat sinuous inner borders. Clypeus small and short, somewhat impressed, its anterior border faintly notched in the middle. Frontal area triangular, concave, about as long as wide, its sides rounded, traversed its entire length by a prominent median carinula. Frontal carinæ rather short, diverging posteriorly. Antennal scape short, somewhat enlarged towards the tip, which does not reach to half the distance between the eye and the posterior corner of the head. All the joints of the funiculus distinctly longer than broad, first joint as long as the three succeeding together, club about as long as the remainder of the funiculus, its two basal joints subequal, together as long as the terminal joint. Humeri rounded, pronotum convex, mesonotum angular above

and behind, basal surface of epinotum flattened, forming an obtuse angle with the sloping declivity. Epinotal spines prominent, longer than broad at their bases, blunt at their tips, directed upward, and parallel with each other; somewhat further apart at their bases than long. Each spine is continued forward as a ridge to the anterior border of the epinotum. Region between the spines concave. Petiole laterally compressed, nearly twice as long as broad; node transverse, its summit concave in the middle when seen from behind; in profile both its anterior and posterior slope concave, the former much longer than the latter. Postpetiole broader than long and broader in front than behind, trapezoidal, its anterior angles small but distinct; in profile its dorsal surface is rounded. Gaster of the usual shape, smaller than the head. Legs moderate.

Mandibles smooth and shining, coarsely and sparsely punctate, striate at their bases. Clypeus and frontal area shining, the former longitudinally rugose except in the middle, which is smooth. Anterior two thirds of head opaque, coarsely longitudinally rugose, posterior third shining and sparsely foveolate. Bottom of occipital furrow transversely ridged. Pronotum smooth and shining, remainder of thorax opaque, reticulate, and punctate-rugose, irregularly on the mesonotum and mesopleuræ, more regularly and densely on the neck and epinotum, where even the spines are rugose. Petiole and postpetiole finely reticulate-rugose, the summits of the nodes smoother and more shining. Gaster and legs glabrous.

Hairs yellowish gray, rather long and suberect on the trunk, short and more appressed on the legs and antennæ, upper surfaces of the femora almost nude.

Black; disks of mandibles, clypeus, anterior fourth of head, except the anterior border, inferior occipital region, mesoepinotal constriction, peduncle of petiole, and legs, with the exception of the middle portions of the femora and tibiæ, red.

*Worker.* — Length 1.75–2 mm.

Mandibles acute, with a sharp apical and four shorter, equidistant, basal teeth. Clypeus convex, with nearly straight anterior border. Head as broad as long, posterior margin slightly excised, posterior angles rounded. Eyes in middle of sides of head, rather prominent. Frontal area and antennæ like those of the soldier, the scape of the latter reaching beyond the posterior angle of the head only to a distance equal to the transverse diameter of the scape. Thorax, petiole and postpetiole as in the soldier, except that the mesonotum is not angular above and behind, and the postpetiole is narrower, scarcely broader, in fact, than the petiole, about as long as broad, subspherical, without prominent angles; and the node of the petiole is not impressed in the middle.

Smooth and shining. Mandibles punctate towards their tips, striate at the base. Cheeks and front of head longitudinally striated,

outer borders of antennal foveæ concentrically rugose. Mesopleuræ, epinotum, and sides, and lower surfaces of petiole and postpetiole evenly reticulate-rugose.

Hairs whitish, rather sparse; long on the trunk, shorter on the legs and antennæ. On the thorax, pedicel, and gaster the hairs are obtuse, elsewhere tapering.

Black; mandibles yellow, sides of thorax, gaster, ventral portions of pedicel and basal half of antennal funiculi, tarsi and articulations of legs, red.

*Female.* — Length 5–5.5 mm.

Mandibles with two acute apical and several smaller and more irregular basal teeth. Head somewhat broader than long, broadest through the posterior angles, occipital border straight, without vertical groove. Eyes just in front of the middle of the sides of the head. Antennal scapes just reaching to the posterior corners. Thorax broad, dorsally very flat; epinotal spines robust, like those of the soldier in shape. Petiole  $1\frac{1}{2}$  times as long as broad, widest behind the middle and through the node, which is transverse but thick and evenly rounded when seen from behind. In profile its anterior slope is long and concave, the summit somewhat truncated and the posterior slope abrupt. Postpetiole nearly twice as broad as the petiole, and nearly twice as broad as long, widest in front of the middle, produced on either side into a prominent, rather acute tooth, which has a convex anterior and a concave posterior border. Gaster and legs of the usual shape.

Mandibles subopaque, coarsely punctate, striated towards the base. Clypeus finely and longitudinally rugose. Head opaque throughout, coarsely longitudinally rugose, the rugæ diverging on the occiput. There is a smooth, shining spot in front of the anterior ocellus and another lateral to either posterior ocellus. Thorax smooth and shining except for the following regions: Pronotum coarsely, longitudinally rugose. Outer borders of mesonotum and of scutellum coarsely punctate, the former also finely and longitudinally striated on either side of the middle. Epinotum concentrically rugose, opaque, except the region between the spines, which is shining. Petiole and postpetiole opaque, finely reticulate-punctate throughout. Gaster and legs smooth and shining, the latter as well as the antennal scapes, which are subopaque, covered with rather coarse, piligerous punctures.

Hairs pale yellow, abundant on the head, thorax, pedicel, and gaster; on the last, reclinate, covering the entire first and the posterior half of each of the remaining segments. On the legs and antennæ the hairs are shorter.

Black; mandibles red with black teeth; cheeks, frontal carinæ, funiculi and tips of scapes, tarsi, ventral half of petiole and the wing-insertions, red. Wings smoky hyaline, with sordid yellow veins and conspicuous blackish stigma.

*Male*. — Length 3.75–4 mm.

Mandibles small, 3-toothed, meeting with their tips. Head, excluding eyes, a little longer than broad, cheeks extremely short, postocular region long, vertex convex, eyes and ocelli large and protruding. Clypeus short, moderately convex, its anterior and posterior borders entire, broadly rounded. Antennæ long, filiform, scape not longer than two first joints of the funiculus; first funicular joint globose, remaining joints cylindrical, growing longer towards the distal end. Thorax robust, broad through the alar insertions. Epinotum with two prominent swellings instead of spines. Petiole twice as long as broad, about as broad behind as in front, node lower and more rounded than in the soldier and female. Postpetiole half again as broad as the petiole, nearly square when seen from above, its anterior angles small and acute, its sides subparallel; in profile its dorsal surface is somewhat flattened. Gaster broad, flattened dorso-ventrally. Legs long and slender.

Smooth and shining; mandibles, head, epinotum, petiole and postpetiole, except the upper surface of the last, opaque. Head reticulate and punctate-rugose, epinotum, petiole, and postpetiole densely and uniformly punctate.

Body and legs covered with delicate, more or less appressed, grayish hairs, longest on the head, thorax, and gaster.

Black; antennæ, venter, genitalia, tarsi and articulations of the legs more piceous. Wings like those of the female.

Like *Ph. pilifera*, *instabilis*, etc., *Ph. ceres* is a harvesting ant which subsists on various seeds stored up in the chambers of its nests. These nests are most commonly found under stones in sunny places, and, so far as my observations go, occur only in the mountains, most abundantly in Colorado at an altitude of from 7000–9000 feet. I have found them in many localities in the Ute Pass, and in the more open cañons of Cheyenne Mt. near Colorado Springs. Other specimens have been received from Boulder, Colo. (Father J. Schmitt, O.S.B.), and from the following localities in New Mexico: San Geronimo and Manzanares (Miss Mary Cooper); San Ignacio (T.D.A. and W. P. Cockerell); Arroyo five miles southeast of Las Vegas (T. D. A. Cockerell). In Colorado the males and females of *Ph. ceres* were found in numbers in the nests during the last week in July. Hence they mature earlier than the males and females of the *Sympheidole*.

**Epipheidole** gen. nov.

Small species allied to *Pheidole*. Workers apparently absent; male and female of about the same size, both winged.

*Female*. — Head, excluding eyes, nearly as broad as long, quadrangular, with prominent posterior and anterior angles, concave posterior border and subparallel sides. Eyes large, projecting, a little in front of the middle of the head; ocelli of moderate size, rather far apart. Mandibles large and convex, with two larger apical and two smaller basal teeth, the latter at the posterior angle of the blade, the intermediate portion of the blade with two indistinct teeth. Labial palpi 2-, maxillary palpi 3-jointed. Clypeus convex, broadly rounded and entire in front, extending back between the antennal insertions behind. Frontal area distinct, triangular, longitudinally carinulate in the middle. Frontal carinae prominent, subparallel, extending back to near the middle of the head. Antennae slender, 12-jointed; scape reaching beyond the posterior corner of the head; first funicular joint long, three last joints forming a distinct club. Thorax like that of *Pheidole*, about as broad as the head. Humeral angles prominent; mesonotum convex in front, much flattened dorsally; epinotum armed with two very large, blunt spines. Petiole and postpetiole like those of *Pheidole*, the former pedunculate, without an antero-median ventral spine, postpetiole rather narrow. Gaster large, broadly elliptical, but little flattened dorsoventrally, as convex on its dorsal as on the ventral side. Legs rather slender, the femora somewhat fusiform, the tibiae stouter towards their distal ends. Strigil well developed, middle and hind tibiae spurless. Wings with large apterostigma and two cubital cells, the second of which is small and triangular. The discal cell is usually absent or open, owing to the disappearance of the recurrent vein. Hairs on the head, thorax and pedicel stout, microscopically frayed at their tips.

*Male*. — Closely resembling the male of *Pheidole*. Head, excluding the eyes, as broad as long. Eyes and ocelli very large and protruding. Cheeks short, postocular region long, but passing over into the posterior corner of the head with less of an angle than in the male of *Sympheidole*. Mandibles small and slender, with two, or sometimes three, distinct teeth. Clypeus convex, broadly rounded in front. Maxillary palpi 3-, labial palpi 2-jointed. Antennae slender, filiform, 13-jointed; scape very short, first funicular joint globose, remaining joints long and cylindrical. Thorax robust, without Mayrian furrows on the mesonotum. Epinotum armed with two broad and prominent spines. Petiole, postpetiole, gaster, and genitalia as in *Pheidole*. Legs very long and slender, last tarsal joint on each leg somewhat dilated. Wings like those of the female. Hairs on the body tapering, not frayed at their tips.



*Epipheidole inquilina* sp. nov.

*Female.* (Figs. 12, 13 and 14.)—Length 3–3.3 mm.

Antennal scape projecting about a fourth its length beyond the posterior corner of the head, distinctly thickened towards the apex; all the funicular joints longer than broad, first joint as long as the three succeeding joints taken together, eighth joint not conspicuously broader though longer than the preceding; terminal joint of club as long as the two preceding, subequal joints together. Epinotal spines very large, blunt, laterally compressed, a little longer than broad at their bases, directed upward, outward, and backward, the distance between their bases about as great as their length. Petiole somewhat more than  $1\frac{1}{2}$  times as long as broad, as broad in front as behind, sides rather concave in the middle, node high and transverse, its anterior slope in profile long and concave, its posterior slope more abruptly concave. Seen from behind the summit of the node is slightly impressed in the middle. Postpetiole distinctly broader than long, widest in the middle, where it is produced on either side to form a rather sharp angle. Gaster more rounded in front than in the female of *Sympheidole*.

Mandibles and clypeus shining, the former with a few large and scattered, piligerous punctures, the latter with a few longitudinal rugæ on the sides. Head subopaque, coarsely reticulate-rugose, the rugæ being especially prominent and longitudinal on the front and crown. Prothorax opaque, finely and evenly reticulate-rugose; mesonotum, paraptera, and scutellum shining, the first rather delicately and irregularly rugose, the paraptera coarsely rugose in the middle and with a few piligerous foveolæ on either side; scutellum smooth and shining in the middle, with a series of piligerous foveolæ on either side near its edge. Epinotum, including the spines, subopaque, covered with fine reticulation. Pleuræ coarsely reticulate-rugose. Petiole and postpetiole sculptured like the epinotum, but with the upper surface of the nodes smooth. Gaster glabrous, shining.

Hairs yellowish, rather scattered and not very conspicuous, reclinate; on the head, thorax, and pedicel stout, frayed at their tips; on the gaster, mandibles, antennæ, and legs the hairs are simple.

Body reddish yellow; legs paler; mandibular teeth, crown of head, mesonotum, scutellum, epinotal spines, upper surface of petiole, postpetiole, and the gaster, excepting its tip and the base of the first segment, dark brown or black. Wings hyaline, veins pale yellowish, apterostigma somewhat deeper in color but not very conspicuous.

*Male.* (Figs. 15, 16, and 17.)—Length 3–3.5 mm.

Antennal scape as long as the first two funicular joints; first funicular joint distinctly longer than broad; remaining joints cylindrical, very gradually increasing in length to the terminal joint, which is

nearly as long as the two preceding joints taken together. Epinotal spines prominent, broader at their bases than long, rather acute, directed upward and backward, about as far apart as the breadth of their bases. Petiole and postpetiole resembling the corresponding segments of the female, except that the node of the former is acute and its posterior slope longer and less concave, and the anterolateral angles of the postpetiole are less prominent.

Mandibles and clypeus shining, the former sparsely punctate, the latter irregularly rugose. Head opaque, finely and longitudinally rugose-punctate. Pronotum and pleuræ subopaque, shagreened; mesonotum smooth and shining, with sparse, shallow, piligerous punctures, except behind, where it is finely longitudinally rugose. Paraptera coarsely and irregularly rugose; scutellum like that of the female, smooth in the middle with lateral foveolæ. Epinotum, including the spines, petiole, and postpetiole, opaque, finely and densely punctate-rugose, the upper surface of the postpetiole, like the gaster, smooth and shining.

Hairs covering the body yellowish, sparse, more or less reclinate slender, and tapering; on the antennæ and legs short and inconspicuous.

Mandibles and antennæ pale yellow; clypeus brown; head black. Thorax yellowish brown, posterior portions of mesonotum and the scutellum dark brown, epinotum black. Petiole black, postpetiole black below, brown above. Gaster dark brown above, tip and genitalia yellow. Legs yellow, femora and tibiæ more or less infuscated. Wings like those of the female.

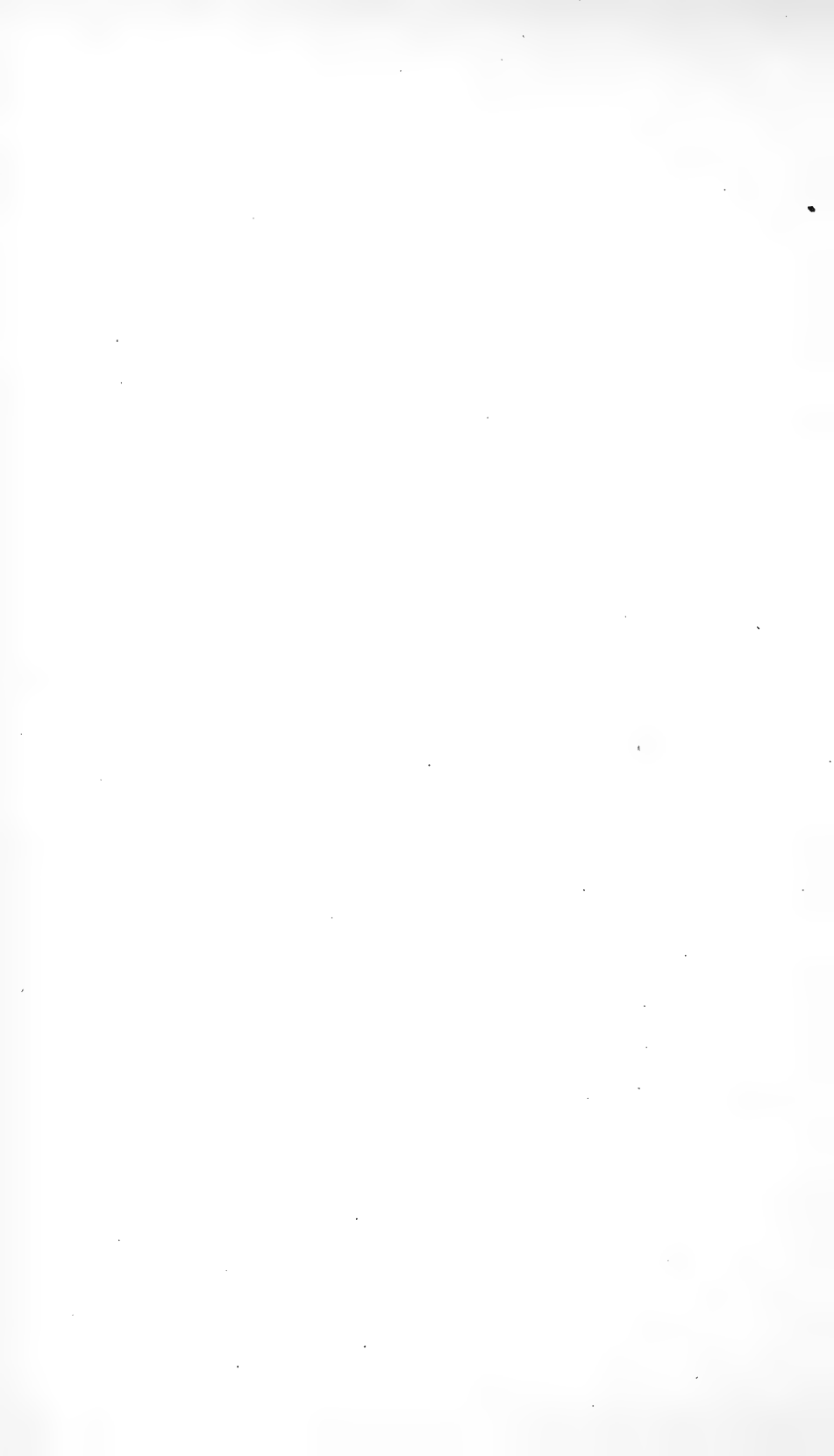
Described from numerous males and females taken from three colonies of *Pheidole pilijera* Roger var. *coloradensis* Emery, found under stones in different localities about Colorado Springs, Colo. The first colony, in Red Rock Cañon, near the Garden of the Gods (July 28), contained many *Epipheidole* males and three *Pheidole* males, besides numerous soldiers and workers of the latter species. The second colony was found at Austin's Bluffs Aug. 10. It contained only a single virgin female of the *Epipheidole*, together with a few *Pheidole* soldiers and workers. The third colony, taken at Broadmoor, Aug. 11, was examined with great care. It contained one deälated female *Epipheidole*, with a distorted gaster, evidently the mother queen of the colony, numerous virgin females, a few males, and a peculiar gynandromorph, which I have described and figured in a former paper.<sup>1</sup> In

<sup>1</sup> Some New Gynandromorphous Ants, with a Review of the Previously Recorded Cases. Bull. Am. Mus. Nat. Hist., Vol. XIX, 1903, pp. 653-683. 11 figs.

this nest there were many *Pheidole* soldiers and workers, all living amicably with the *Epipheidole*, but no worker forms that could by any possibility be referred to the latter species were to be found either in this or the other nests. Nor was I able to find queens of the *Pheidole* in any of the colonies, so that it is probable that *Epipheidole*, like *Anergates* and *Symphheidole*, does not permit the females of its host species to mature. Unfortunately all of these colonies were found on occasions when I was not prepared to capture them alive and keep them under observation in artificial nests.

As in the case of the preceding species, the males and females of *Ph. coloradensis* mature earlier in the year than the corresponding sexes of the inquiline. The three males of the former species taken July 28 were belated individuals since the majority of *coloradensis* colonies near Colorado Springs gave off their males and females early in July.

[January, 1904.]





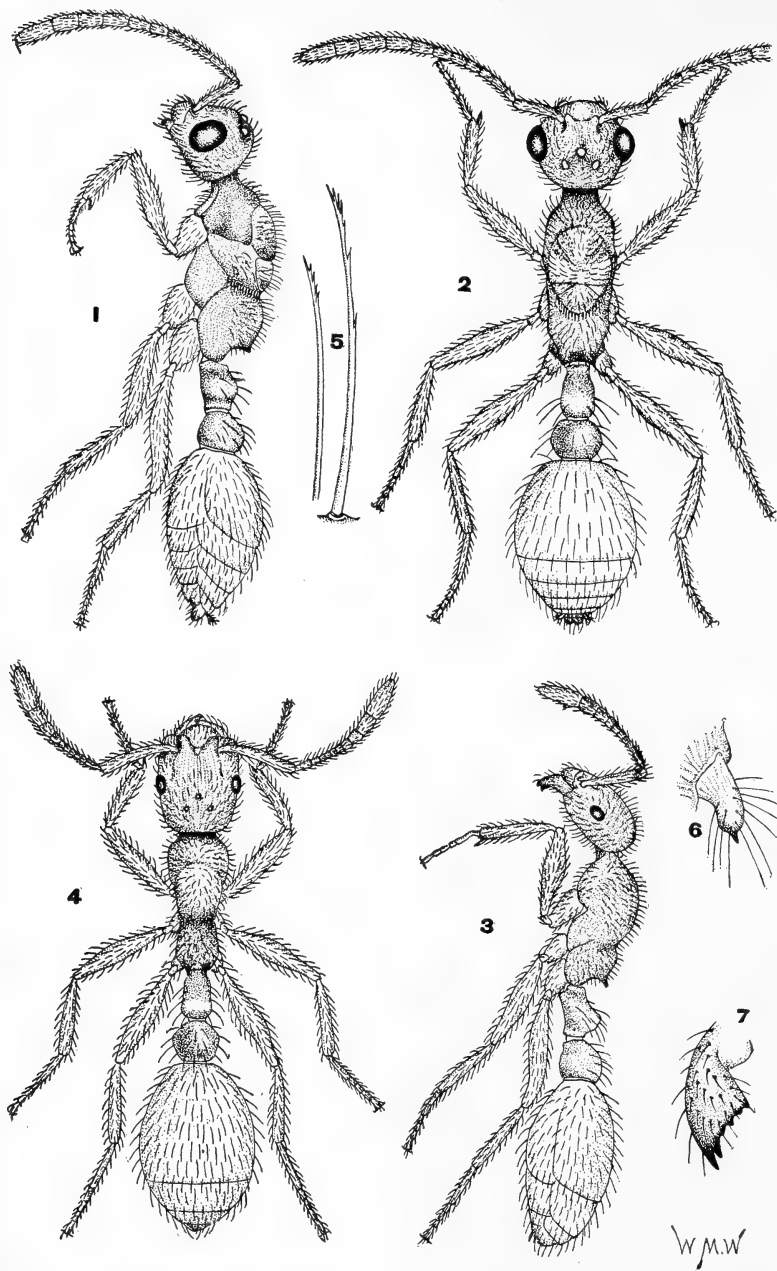


Fig. 1. Male of *Symmyrmica chamberlini* gen. nov. et sp. nov. Lateral view.

Fig. 2. Dorsal view of the same.

Fig. 3. Worker of *Symmyrmica chamberlini*. Lateral view.

Fig. 4. Worker of *Symmyrmica chamberlini*. Dorsal view.

Fig. 5. Hairs from gaster of worker *Symmyrmica*, highly magnified.

Fig. 6. Mandible of male *Symmyrmica*.

Fig. 7. Mandible of worker *Symmyrmica*.

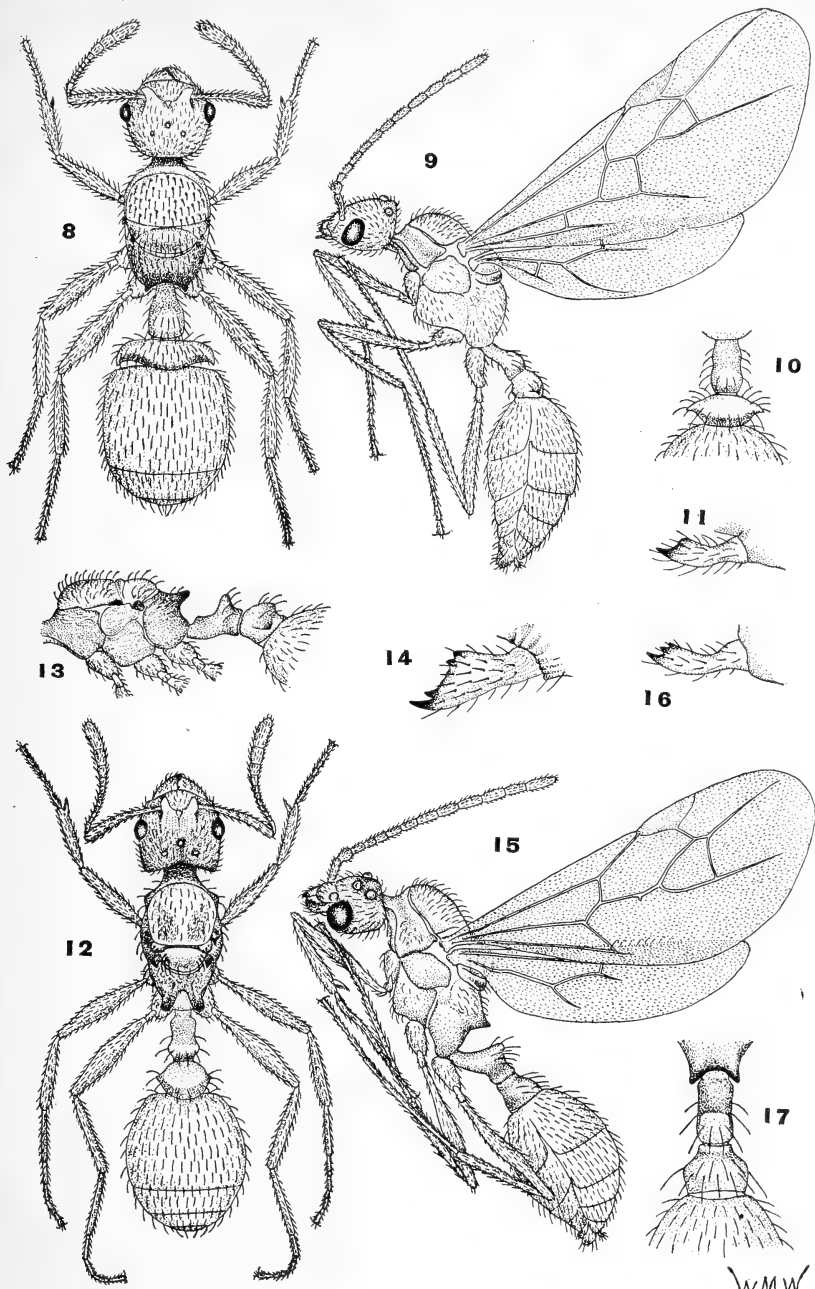


Fig. 8. Female *Symphheidole elecebra* gen. nov.  
et sp. nov. (deälated). Dorsal view.

Fig. 9. Male of same. Lateral view.

Fig. 10. Pedicel of male *Symphheidole*. Dorsal view.

Fig. 11. Mandible of same.

Fig. 12. Female *Epipheidole inquilina* gen. nov.  
et sp. nov. (deälated). Dorsal view.

Fig. 13. Thorax and pedicel of same. Lateral view.

Fig. 14. Mandible of same.

Fig. 15. Male *Epipheidole inquilina*. Lateral view.

Fig. 16. Mandible of same.

Fig. 17. Pedicel of male *Epipheidole*. Dorsal view.





## Article II. — NEW FORMS OF THE MOUNTAIN GOAT (OREAMNOS).

By J. A. ALLEN.

The type locality of *Oreamnos montanus* (Ord) is given by Miller and Rehn (Proc. Boston Soc. Nat. Hist., XXX, No. 1, Dec. 1901, p. 23) as the "Cascade Range, near the Columbia River, in Oregon and Washington." A comparison of specimens of *Oreamnos* from the Cascades of northern Washington with others from Montana and northern British Columbia shows that the species commonly recognized as *O. montanus* is separable into three geographical forms, namely, (1) *O. montanus montanus* from the Cascades, (2) a much larger form, with longer and narrower skull, from British Columbia, and (3) a much smaller form, with the same type of skull as the last, from Montana and Idaho. As the pelage in all the forms is white, the distinctive characters must rest on size and the form of the skull, so far as present material is available. These forms may be distinguished as follows:

Size medium, skull broad.....*O. montanus montanus* (Ord).  
Size large, skull narrow.....*O. montanus columbianus*, subsp. nov.  
Size small, skull narrow.....*O. montanus missoulæ*, subsp. nov.

The material available for the present comparison consists of 19 specimens, of which 3 are from the Cascades of northern Washington, 7 from British Columbia (4 from the Shesley Mountains, northern British Columbia, and 3 from near Golden, southern British Columbia), 8 from Montana (mainly from Missoula County), and 1 from Idaho. They include adult males of each of the three forms, and adult females and young males of two of them.

### *Oreamnos montanus montanus* (Ord).

Old male skull (No. 14890, Cascade Mountains, northern Washington, Prof. L. L. Dyche), occipito-nasal length, 312; basal length of Hensel, 270; zygomatic breadth, 114; interorbital breadth, 95; width of maxillary region above  $m^2$ , 86.5; nasals, 104 x 34; length of palate,

176; upper toothrow (on alveolar line), 73; ratio of interorbital breadth to basal length, 41. Hoof of outer digit of fore foot (at edge of hair), 66 x 30; do. hind foot, 57 x 28.

An adult female skull measures, occipito-nasal length, 291; basal length, — (skull imperfect); zygomatic breadth, 105; interorbital breadth, 87; width of maxillary region above  $m^2$ , 80; nasals, 85 x 32; length of palate, 169; upper toothrow, 76.5

The collector's external measurements, in part, are as follows: Femur to humerus,  $33\frac{1}{2}$  in. (851 mm.); height at shoulders,  $39\frac{1}{4}$  in. (997 mm.).

### ***Oreamnos montanus columbianus*, subsp. nov.**

Type, No. 19838, ♂ ad., Shesley Mountains, northern British Columbia; Andrew J. Stone.

Old male skull (type), occipito-nasal length, 336; basal length of Hensel, 293; zygomatic breadth, 119; interorbital breadth, 98; width of maxillary region above  $m^2$ , 87; nasals, 122 x 38; length of palate, 184; upper toothrow, 77; ratio of interorbital breadth to basal length, 35. Hoof of outer digit of fore foot, 74 x 35; do. hind foot, 66 x 33.

The collector's external measurements are, in part, as follows: Femur to humerus, 36 in. (914 mm.); height at shoulder, 43 in. (1088 mm.).

Two other males, adult but not so old, are slightly smaller, having an occipito-nasal length, respectively, of 332 and 299. Three skulls from the Selkirk Mountains (near Golden), southern British Columbia, collected and presented by Messrs. Madison Grant and C. A. Moore, Jr., agree almost exactly in measurements and proportions with the two largest skulls from the Shesley Mountains in northern British Columbia.

### ***Oreamnos montanus missoulæ*, subsp. nov.**

Type, No. 19336, ♂ ad., Missoula, Montana; E. S. Hathaway.

Old male skull (type), occipito-nasal length, 299; basal length of Hensel, — (basioccipital region mutilated); zygomatic breadth, 108; interorbital breadth, 87; width of maxillary region above  $m^2$ , 81; nasals, 104 x 33; length of palate, —; upper toothrow, 69; ratio of interorbital breadth to basal length, —. Hoof of outer digit of fore foot, 56 x 28; do. hind foot, 52 x 26.

There are no collector's external measurements available.

Another Montana specimen (skull), not quite so old, but a mature adult, is slightly smaller. An old female skull measures, occipito-nasal length, 280; basal length, — (basioccipital region imperfect); zygomatic breadth, —; interorbital breadth, 80; width of maxillary

region above  $m^2$ , 73; nasals,  $96 \times 27$ ; length of palate, (imperfect); upper toothrow, 74.

The difference in size between the Montana and British Columbia specimens is striking; the Cascade specimens are intermediate in size between these two forms, but differ from either in the markedly greater relative breadth of the skull.



**Article III. — THE TYPES OF CYNIPIDÆ IN THE COLLECTION OF THE AMERICAN MUSEUM OF NATURAL HISTORY.**

By WILLIAM BEUTENMÜLLER.

Through the kindness and generosity of Mrs. Margaret Bassett, widow of the late Homer F. Bassett, the well-known authority on North American Cynipidæ, the Museum came in possession of the types of Gall-flies and Galls described by Bassett, mentioned in the present paper.

The material is a selection of duplicate types of the Bassett collection which has been deposited with the American Entomological Society.

The species given in the supplement of this paper were presented to the American Museum of Natural History many years ago by Baron Osten Sacken. These specimens are not the original types, but may be classed as cotypes. They were selected from the Osten Sacken collection, as far as I am aware, before the same was deposited in the Cambridge Museum.

**Rhodites bassettii** Beuten., Bull. Am. Mus. Nat. Hist., Vol. IV, 1892, p. 248, pl. ix, fig. 7.

Gall-flies and galls.

**Rhodites lenticularis** Bass., Trans. Am. Ent. Soc., Vol. XVII, 1890, p. 59.

Gall-flies and galls.

**Rhodites tumidus** Bass., Trans. Am. Ent. Soc., Vol. XVII, 1890, p. 60.

Gall-flies and galls.

**Rhodites variabilis** Bass., Trans. Am. Ent. Soc., Vol. XVII, 1890, p. 61.

Gall-flies and galls.

**Diastrophus potentillæ** Bass., Proc. Ent. Soc. Phila., Vol. III, 1864, p. 689.

Gall-flies and galls.

**Diastrophus radicum** Bass., Can. Ent., Vol. II, 1870, p. 98.

Gall-flies and galls.

**Diastrophus turdigus** Bass., Can. Ent., Vol. II, 1870, p. 99.

Gall-flies and galls.

**Aulax tumidus** Bass., Trans. Am. Ent. Soc., Vol. XVII, 1890, p. 92.

Gall-flies and galls.

- Aulax podagræ** Bass., Trans. Am. Ent. Soc., Vol. XVII, 1890, p. 91.  
Gall-flies and galls.
- Amphibolips ilicifoliæ** Bass., Proc. Ent. Soc. Phila., Vol. III, 1864, p. 682 (*Cynips*).  
Galls only.
- Amphibolips gainesi** Bass., Trans. Am. Ent. Soc., Vol. XXVI, 1900, p. 322.  
Galls only.
- Amphibolips sculptus** Bass., Proc. Ent. Soc. Phila., Vol. II, 1863, p. 324 (*Cynips*).  
Gall-flies and galls.
- Andricus patiens** Bass., Trans. Am. Ent. Soc., Vol. XXVI, 1900, p. 312.  
Gall-flies only.
- Andricus exiguus** Bass., Trans. Am. Ent. Soc., Vol. XXVI, 1900, p. 318.  
Gall-flies only.
- Andricus piger** Bass., Can. Ent., Vol. XIII, 1881, p. 105 (*Cynips pigra*).  
Gall-flies and galls.
- Andricus piperoides** Bass., Trans. Am. Ent. Soc., Vol. XXVI, 1900, p. 314.  
Gall-flies and galls.
- Andricus crystallinus** Bass., Trans. Am. Ent. Soc., Vol. XXVI, 1900, p. 319.  
Galls only.
- Andricus utriculus** Bass., Can. Ent., Vol. XIII, 1881, p. 78 (*Cynips*).  
Gall-flies and galls.
- Andricus pomiformis** Bass., Can. Ent., Vol. XIII, 1881, p. 74 (*Cynips*).  
Gall-flies and galls.
- Andricus speciosus** Bass., Trans. Am. Ent. Soc., Vol. XVII, 1890, p. 81.  
Gall-flies and galls.
- Andricus capsula** Bass., Can. Ent., Vol. XIII, 1881, p. 101 (*Cynips*).  
Gall-flies and galls.
- Andricus ashmeadii** Bass., Trans. Am. Ent. Soc., Vol. XXVI, 1900, p. 320.  
Gall-flies only.
- Andricus batatoides** Ashm., Trans. Am. Ent. Soc., Vol. IX, 1881, p. xi.  
Gall-flies and galls.
- Callirhytis osten-sackenii** Bass., Proc. Ent. Soc. Phila., Vol. II, 1863, p. 327 (*Cynips*).  
Gall-flies and galls.
- Callirhytis clavula** Bass., Proc. Ent. Soc. Phila., Vol. IV, 1864, p. 351 (*Cynips*).  
Gall-flies and galls.
- Callirhytis agrifoliæ** Bass., Can. Ent., Vol. XIII, 1881, p. 53 (*Cynips*).  
Gall-flies and galls.

- Callirhytis scitula** Bass., Proc. Ent. Soc. Phila., Vol. III, 1864, p. 683  
(*Cynips*).  
Gall-flies and galls.
- Callirhytis singularis** Bass., Proc. Ent. Soc. Phila., Vol. II, 1863, p. 326  
(*Cynips*).  
Gall-flies and galls.
- Callirhytis similis** Bass., Proc. Ent. Soc. Phila., Vol. III, 1864, p. 685  
(*Cynips*).  
Gall-flies and galls.
- Callirhytis californicus** Bass., Can. Ent., Vol. XIII, 1881, p. 51 (*Cynips*).  
Gall-flies and galls.
- Callirhytis clarkei** Bass., Trans. Am. Ent. Soc., Vol. XVII, 1890, p. 79.  
Gall-flies and galls.
- Callirhytis cicatricula** Bass., Can. Ent., Vol. XIII, 1881, p. 101. (*Cynips*.);  
Trans. Am. Ent. Soc., Vol. XVII, 1890, p. 80 (*Andricus*).  
Gall-flies and galls.
- Callirhytis pulchra** Bass., Trans. Am. Ent. Soc., Vol. XVII, 1890, p. 73.  
Gall-flies and galls.
- Callirhytis punctata** Bass., Proc. Ent. Soc. Phila., Vol. II, 1863, p. 324  
(*Cynips*).  
Gall-flies and galls.
- Callirhytis suttonii** Bass., Can. Ent., Vol. XIII, 1881, p. 54 (*Cynips*).  
Gall-flies and galls.
- Callirhytis tuberosa** Bass., Trans. Am. Ent. Soc., Vol. XXVI, 1900,  
p. 311.  
Gall-flies and galls.
- Acraspis macrocarpæ** Bass., Trans. Am. Ent. Soc., Vol. XVII, 1890,  
p. 84.  
Gall-flies and galls.
- Acraspis gillettii** Bass., Trans. Am. Ent. Soc., Vol. XXVI, 1900, p. 323.  
Gall-flies and galls.
- Biorhiza hirta** Bass., Proc. Ent. Soc. Phila., Vol. III, 1864, p. 688  
(*Cynips*).  
Gall-flies and galls.
- Loxaulis mammula** Bass., Can. Ent., Vol. XIII, 1881, p. 76 (*Cynips*).  
Gall-flies and galls.
- Dryophanta bella** Bass., Can. Ent., Vol. XIII, 1881, p. 93 (*Cynips*).  
Galls only.
- Dryophanta eburneus** Bass., Trans. Am. Ent. Soc., Vol. XVII, 1890,  
p. 70.  
Gall-flies and galls.
- Dryophanta gemmula** Bass., Can. Ent., Vol. XIII, 1881, p. 104  
(*Cynips*).  
Gall-flies and galls.
- Dryophanta papula** Bass., Can. Ent., Vol. XIII, 1881, p. 107 (*Cynips*).  
Gall-flies and galls.

- Dryophanta ignota** Bass., Can. Ent., Vol. XIII, 1881, p. 106 (*Cynips*).  
Gall-flies and galls.
- Dryophanta pumiliventris** Bass., Trans. Am. Ent. Soc., Vol. XVII, 1890, p. 69.  
Gall-flies and galls.
- Neuroterus floccosus** Bass., Can. Ent., Vol. XIII, 1881, p. 111 (*Cynips*).  
Gall-flies and galls.
- Neuroterus tectus** Bass., Trans. Am. Ent. Soc., Vol. XXVI, 1900, p. 331.  
Gall-flies and galls.
- Neuroterus majalis** Bass., Proc. Ent. Soc. Phila., Vol. III, 1864, p. 683 (*Cynips*).  
Gall-flies and galls.
- Neuroterus favosus** Bass., Trans. Am. Ent. Soc., Vol. XVII, 1890, p. 87.  
Gall-flies and galls.
- Neuroterus distortus** Bass., Trans. Am. Ent. Soc., Vol. XXVI, 1900, p. 336.  
Gall-flies and galls.
- Neuroterus batatus** Bass. (summer form), Proc. Ent. Soc. Phila., Vol. III, 1864, p. 684 (*Cynips*).  
Gall-flies and galls.
- Neuroterus batatus** (Fitch) Bass. (winter form), Proc. Ent. Soc. Phila., Vol. III, 1864, p. 684 (*Cynips*).  
Gall-flies and galls.
- Neuroterus umbilicatus** Bass., Trans. Am. Ent. Soc., Vol. XXVI, 1900, p. 330.  
Galls only.
- Neuroterus exiguissimus** Bass., Trans. Am. Ent. Soc., Vol. XXVI, 1900, p. 332.  
Gall-flies and galls.
- Neuroterus vesicula** Bass., Can. Ent., Vol. XIII, 1881, p. 97 (*Cynips*).  
Gall-flies and galls.
- Neuroterus exiguus** Bass., Trans. Am. Ent. Soc., Vol. XXVI, 1900, p. 333.  
Gall-flies and galls.
- Neuroterus pallidus** Bass., Trans. Am. Ent. Soc., Vol. XVII, 1890, p. 88.  
Gall-flies and galls.
- Neuroterus minutus** Bass., Can. Ent., Vol. XIII, 1881, p. 96 (*Cynips*).  
Gall-flies and galls.
- Neuroterus affinis** Bass., Can. Ent., Vol. XIII, 1881, p. 103 (*Cynips*).  
Gall-flies and galls.
- Neuroterus noxiosus** Bass. (summer form), Can. Ent., Vol. XIII, 1881, p. 108 (*Cynips*).  
Gall-flies and galls.



- Neuroterus noxiosus** Bass. (winter form), Can. Ent., Vol. XIII, 1881, p. 108 (*Cynips*).  
Gall-flies and galls.
- Holcaspis duricoria** Bass., Trans. Am. Ent. Soc., Vol. XVII, 1890, p. 64.  
Gall-flies and galls.
- Holcaspis ficula** Bass., Can. Ent., Vol. XIII, 1881, p. 75 (*Cynips*).  
Galls only.
- Holcaspis rugosa** Bass., Can. Ent., Vol. XIII, 1881, p. 100 (*Cynips*).  
Gall-flies and galls.
- Holcaspis corallinus** Bass., Trans. Am. Ent. Soc., Vol. XVII, 1890, p. 66.  
Galls only.
- Holcaspis pedunculata** Bass., Trans. Am. Ent. Soc., Vol. XVII, 1890, p. 72 (*Dryophanta*).  
Gall-flies and galls.
- Holcaspis fasciata** Bass., Trans. Am. Ent. Soc., Vol. XXVI, 1900, p. 328.  
Gall-flies and galls.
- Cynips ? prinoides** Beuten., Bull. Am. Mus. Nat. Hist., Vol. IV, 1892, p. 257, pl. xi, fig. 6.

## SUPPLEMENT.

- Rhodites ignota** O. S., Proc. Ent. Soc. Phila., Vol. II, 1863, p. 49.  
Gall only.
- Rhodites radicum** O. S., Proc. Ent. Soc. Phila., Vol. II, 1863, p. 46.  
Gall only.
- Rhodites verna** O. S., Proc. Ent. Soc. Phila., Vol. II, 1863, p. 47.  
Gall only.
- Diastrophus nebulosus** O. S., Proc. Ent. Soc. Phila., Vol. II, 1863, p. 36.  
Gall only.
- Diastrophus cuscutæformis** O. S., Proc. Ent. Soc. Phila., Vol. II, 1863, p. 39.  
Gall only.
- Amphibolips inanis** O. S., Proc. Ent. Soc. Phila., Vol. I, 1861, p. 58.  
Gall only.
- Amphibolips spongifica** O. S., Proc. Ent. Soc. Phila., Vol. I, 1862, pp. 244, 248.  
Gall only.
- Andricus cornigerus** O. S., Proc. Ent. Soc. Phila., Vol. I, 1862, p. 251, and Vol. IV, 1864, p. 358 (*Cynips*).  
Gall only.
- Andricus tumifica** O. S., Proc. Ent. Soc. Phila., Vol. IV, 1865, p. 356 (*Cynips*).  
Gall only.
- Andricus futilis** O. S., Proc. Ent. Soc. Phila., Vol. I, 1861, p. 63 (*Cynips*).  
Gall only.

**Andricus papillatus** O. S., Proc. Ent. Soc. Phila., Vol. I, 1861, p. 64,  
and Vol. IV, 1864, p. 352 (*Cynips*).

Gall only.

**Andricus tubicola** O. S., Proc. Ent. Soc. Phila., Vol. I, 1861, p. 60  
(*Cynips*).

Gall only.

**Cynips strobilana** O. S., Proc. Ent. Soc. Phila., Vol. IV, 1865, p. 349.

Gall only.

**Acraspis pezomachoides** O. S., Proc. Ent. Soc. Phila., Vol. I, 1862, p.  
250 (*Cynips*).

Gall only.

## Article IV. — MAMMALS FROM SOUTHERN MEXICO AND CENTRAL AND SOUTH AMERICA.

By J. A. ALLEN.

During the last three years the Museum has obtained by purchase several small collections of mammals from Mexico and Central America, the more important of which are the three which form the subject of the present paper. In working up these collections much other material previously in the Museum, including considerable from Colombia and Venezuela, has been critically examined, with the result that a number of apparently new forms have been discovered, and are here included.

In this connection I wish especially to acknowledge my indebtedness to Mr. Outram Bangs, Curator of Mammals at the Museum of Comparative Zoölogy, Cambridge, Mass., for the generous loan of types, topotypes, and other material from Chiriqui and elsewhere; to Mr. Gerrit S. Miller, Jr., in charge of the collection of mammals at the U. S. National Museum, for the use of specimens from Mexico and Costa Rica; and to Dr. C. Hart Merriam, Chief of the Biological Survey, U. S. Department of Agriculture, for the loan of specimens, and for aid in determining some of the smaller rodents in the Vera Cruz collection.

### I. — SOUTHERN VERA CRUZ, MEXICO.

A collection of about 150 specimens of mammals was made for the Museum by Mr. E. A. Colburn, in the State of Vera Cruz, during March and April, 1901. The collection, however, contained no bats. The locality given for the specimens is "Pasa Nueva," situated a short distance from Tlacotalpan, about 60 miles south of the city of Vera Cruz, in the low tropical coast belt.

1. **Marmosa murina mexicana** *Merriam*. Two specimens, male and female, March 11.

2. *Metachirus fuscogriseus pallidus* Allen. One specimen, adult male, April 6. Total length, 581; tail vertebræ, 301; hind foot, 40.

3. *Didelphis mesamericana tabascensis* Allen. Two specimens, male and female, March 3 and 11.

4. *Tamandua tetradactyla* (Linn.). Six specimens — 1 young male, 5 adult females — March 16-19, April 2-12.

5. *Tayassu angulatum humerale* Merriam. Three specimens, March 15 and April 5 and 15.

6. *Odocoileus toltecus* (Saussure). Four specimens, 3 males (2 young) and 1 female, March 14 and April 10 and 12.

7. *Sciurus aureogaster hypopyrrhus* (Wagler). Eighteen specimens, March and April. Four are in the usual red phase, 8 are uniform intense black, and 5 are intermediate, but approach the black phase more than the red phase, most of them having merely a little red on the ventral surface, the rest of the pelage being intense black.

8. *Peromyscus affinis* (Allen). Twenty-two specimens, March 10-April 12.

Young adults are darker than old adults, with the median dorsal area blackish. About half the specimens have a small area of chestnut on the breast, varying in size and distinctness from a mere trace to a well-defined and strongly colored patch, the rest being without even a trace of this marking. Adults range in total length from 170 to 190, averaging about 180; tail vertebræ, 70 to 81, averaging 75; hind foot, 20 to 20.4, averaging 20.2.

9. *Peromyscus mexicanus* (Saussure). Eight specimens, March 10-13, and April 6; 4 old adults, 3 young adults, and 1 two thirds-grown young. The adults range in total length from 220 to 240 (av. 230); in length of tail vertebræ from 110 to 120 (av. 114); hind foot, av. 20.5.

10. *Oryzomys rostratus* Merriam. Six specimens, 4 of which are adult, March 11-17 and April 4. Length of adults

221-240 (av. 233); tail vertebræ, 110-121 (av. 118); hind foot, 20.7.

11. *Oryzomys jalapæ rufinus* Merriam. One adult male, April 9. Total length, 260; tail, 140.5; hind foot, 20.9.

12. *Sigmodon toltecus* (Saussure). Four specimens, April 5-13.

13. *Liomys pictus rostratus* Merriam. Twelve specimens, March and April. Five adult males: Total length, 257 (250-260); tail vertebræ, 130 (123-140); hind foot, 29.6 (29-30).

14. *Lepus (Sylvilagus) russatus*, sp. nov.

FIGURES 1, 4, AND 7.

Type, No. 17203, ♂ ad., Pasa Nueva, Vera Cruz, Mexico, April 10, 1901; A. E. Colburn.

Pelage coarse and harsh. General coloration above, including upper surface of head, whole dorsal region, and upper surface of tail, pale brownish russet, varied with dark brown; sides and hips varied with creamy white; nape patch, anterior surface of fore limbs, and outer surface of hind limbs, ferruginous; cheeks and sides of neck like back but strongly varied with black; ventral surface yellowish white, the darker color of the sides encroaching on the sides of the abdomen; prepectoral band clay color; upper surface of hind feet creamy white; ears externally grayish brown, slightly tinged with pale rusty, and gradually darkening on the apical third to blackish.

*Measurements.* — Total length, 450; tail vertebræ, 42; hind foot, 80; ear from crown (in dry skin), 62. Skull, occipito-nasal length, 78.5; basal length (inner base of incisors to posterior border of occipital condyles), 63; greatest zygomatic breadth, 35.2; interorbital breadth, 17; mastoid breadth, 28; width of braincase, 25; length of nasals, 36; width at posterior border, 17; length of palatal bridge, 7.5 (10 to tip of frontal spine); length of malar, 33.5; upper toothrow (crown surface), 6.5; palatal foramina, 19, by 7 at posterior border; length of lower jaw (front base of incisors to angle), 55; height at condyle, 35.

The skull is narrow for its length; the occipital portion only moderately depressed, audital bullæ very large for the size of the skull, nearly twice as large as in skulls of *Lepus aztecus* of practically the same size.

*Lepus russatus* is distinguished from its nearest geographical allies, *L. aztecus* (Figs. 2, 5, 8) and *veræ-crucis*, by the russet

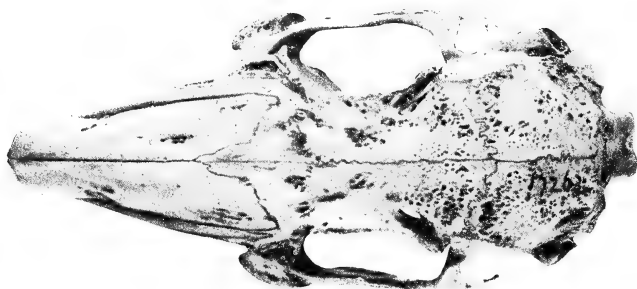


Fig. 1. *Lepus russatus*. No. 17203. ♂ ad. Type. Nat. size.



Fig. 2. *Lepus aztecus*. No.  $\frac{3116}{2438}$ . ♂ ad., Tehuantepec, Mexico. Type. Nat. size.



Fig. 3. *Lepus parvulus*. No. 10888, adult. Type. Nat. size.

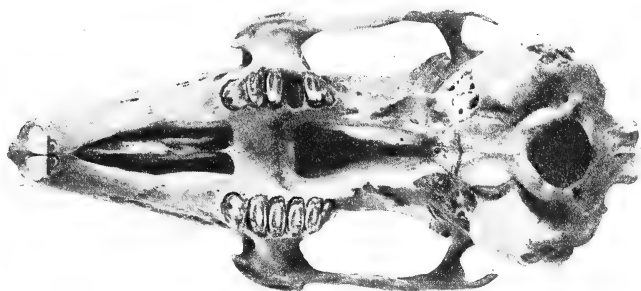


Fig. 4. *Lepus russatus*. From same skull as Fig. 1. Nat. size.

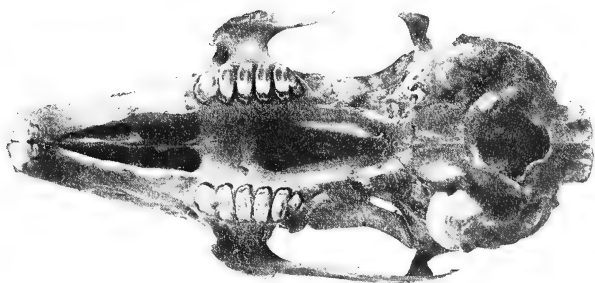


Fig. 5. *Lepus aztecus*. Same skull as Fig. 2. Nat. size.

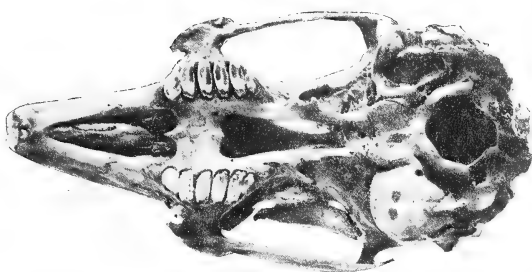


Fig. 6. *Lepus parvulus*. Same skull as Fig. 3. Nat. size.

brown color of the whole dorsal area, with the tips of the hairs dark reddish brown instead of blackish, small ears, very large audital bullæ, and the narrowness of the skull, as shown by the interorbital measurement. In coloration *L. aztecus* is not so dark brown on the middle dorsal region, and the cheeks and sides of the body are gray instead of like the back, and the under surface is broadly white instead of narrowly yellowish white; the pelage is also much finer and softer. The skulls are distinguishable at a glance by the large size of the bullæ in *L. russatus*, the much narrower basioccipital, and by other less obvious differences. Although represented by a single specimen (fortunately in excellent pelage), the differences which distinguish it from the nearest known allied species are too strongly marked to be easily overlooked.

I take this opportunity also to record a previously undescribed very small *Sylvilagus* from the arid tablelands of southern Hidalgo, collected at Apam, by Mr. Frank M. Chapman in March, 1897.

***Lepus (Sylvilagus) parvulus*, sp. nov.**

FIGURES 3, 6, AND 9.

Type, No.  $\frac{12578}{10888}$ , Apam (altitude about 8000 feet), southern Hidalgo, Mexico, March 19, 1897; Frank M. Chapman.

General color above pale buff, strongly varied with black, the hairs being subapically buff, with conspicuously long black tips, the prevailing color over the posterior half of the dorsal surface being blackish, indistinctly lighter and slightly grayish on the rump; chin, throat, and middle ventral surface yellowish white, the color of the sides extending well down upon the sides of the abdomen; prepectoral area very broad, pale rusty brown; nape patch pale ferrugineous; upper surface of fore feet pale rusty, of the hind feet still lighter or deep buff; eyering deep buff; sides of head buffy brown, varied with black-tipped hairs; ears externally buffy gray brown, darker, almost black on the outer edge and at the tip; ears internally pale yellowish brown with a deep buffy edging; upper surface of tail blackish, the extreme tips of the hairs buffy gray.

Total length, 390; tail vertebrae, —; hind foot, 75; ear, 65. Skull, occipito-nasal length, 65; basal length, 54.5; greatest zygomatic breadth, 33; interorbital breadth, 18.4; mastoid breadth, 27; width





Fig. 7. *Lepus russatus*. Same skull as Fig. 1. Nat. size.



Fig. 8. *Lepus aztecus*. Same skull as Fig. 2. Nat. size.

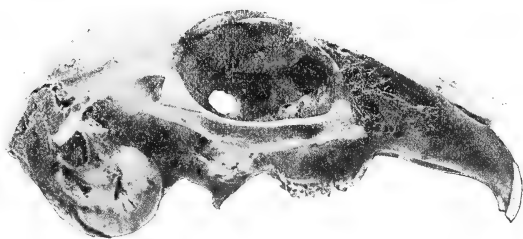


Fig. 9. *Lepus parvulus*. Same skull as Fig. 3. Nat. size.

of braincase, 25; length of nasals, 25; width of nasals, posteriorly, 13.5; length of palatal bridge, 5.2 (with spines, 8.5); length of malar, 28; upper toothrow (crown surface), 10; palatal foramina, 14.5, by 5.2 at point of greatest width; length of lower jaw, 43; height at angle, 25.5.

Skull rather broad, upper contour strongly arched posteriorly; bullæ very large for the size of the skull, much larger than in *L. aztecus*, although the general size of the skull is nearly one half less.

A second specimen is similar, but paler throughout, including the nape patch, feet, and ground color of the upper parts; it is also slightly smaller and somewhat younger, though adult.

In general size *L. parvulus* is similar to *L. bachmani* and *L. cinerascens*, but it differs too widely from them in cranial characters to need further comparison. In skull structure it seems to be a diminutive member of the *Sylvilagus* group, from all other forms of which its small size will distinguish it.

15. ***Conepatus (Marputius) tropicalis* Merriam.** Two specimens, April 6.

16. ***Tayra barbara senex* (Thomas).** One specimen, adult female, March 18. Total length, 1000; tail vertebræ, 375; hind foot, 115.

In attempting, in this connection, to determine the various South American examples of Tayras in the Museum collection it has been found that the series from Santa Marta, Colombia, represents a well-marked, undescribed form, which may be characterized as follows:

***Tayra barbara irara*,<sup>1</sup> subsp. nov.**

Type, No. 15469, ♂ ad., Bonda, Santa Marta District, Colombia, June 6, 1899; Herbert H. Smith Collection.

Top and sides of head and neck grayish brown; throat and foreneck dark brown, with a small pale yellowish spot on lower neck; whole body and limbs very dark brown, darker or nearly black along the middle of the back, forming an indistinct dorsal band, continued on the tail; tail rather darker than the body, brownish black, becoming nearly black apically. The yellow throat patch varies, in different individuals, in color from cream to ochraceous, and in size from a small oblong spot less than 20 mm. long and about 6 mm. wide to a large

<sup>1</sup> *Irara*, the native local name.

triangular area 50 mm. wide and 75 mm. long, the apex pointing backward; but the outline is often more or less irregular.

*Measurements.* — Type, total length, 1016; tail, 381; hind foot, 114. In 8 adult specimens, all from the vicinity of Bonda, the external measurements are as follows:

14860, ♂,	Total length,	1133;	tail vertebræ,	356;	hind foot,	102.
14630, ♂,	" "	1080;	" "	449;	" "	92.
15472, ♂,	" "	1044;	" "	—;	" "	—.
15471, ♂,	" "	1016;	" "	446;	" "	89.
14629, ♂ juv.	" "	991;	" "	394;	" "	102.
14861, ♀,	" "	953;	" "	381;	" "	—.
15469, ♀,	" "	1016;	" "	381;	" "	104.
14631, ♀?,	" "	750;	" "	330;	" "	89.

The skull of the type measures: Occipito-nasal length, 111; basal length, 106.5; zygomatic breadth, 59; width of braincase, 47; post-orbital constriction, 21.5; interorbital breadth, 25.5; upper toothrow, — (imperfect). Another old male skull, with practically the same dimensions (about a millimeter less), has the upper toothrow 22. The females are somewhat smaller.

Represented by 10 specimens, 8 of which are adult and 2 rather young, all collected at or in the immediate vicinity of Bonda (altitude 250 feet), Santa Marta district, during the months of February, March, April, June, August, and November, all seasons being thus represented. They vary but little in general color, but one or two are rather darker than the others. Singularly enough, 7 of the 10 specimens have a whitish patch on the 'withers,' but it varies greatly in size, from a mere trace to a large spot, as follows:

No. 14861, ♀, an oval spot on the left side of the median line, 20 mm. long by 5 mm. wide.

No. 14629, ♂, a diamond-shaped spot, 40 x 40 mm.

No. 15471, ♂, a triangular spot, with the apex directed backward, 46 mm. across the front, and 45 in length.

No. 14630, ♂?, a triangular spot, as in the last, 40 x 45 mm.

No. 14860, ♂?, a subtriangular spot, with the right anterior angle lengthened, 38 x 49 mm.

No. 14631, ♀?, a patch of very irregular form, 50 mm. wide by 75 mm. long.

No. 15470, ♂, a crescentic patch, opening forward, 95 mm. across from point to point, and 125 mm. long, measured from a transverse line

across the points of the crescent to the point of greatest convexity, the greatest width of the light band being 55 mm.

This feature is of interest in connection with Mr. Thomas's remarks (Ann. and Mag. Nat. Hist. (7), V, Jan., 1900, pp. 147, 148) in reference to three specimens from widely separated localities showing this "spasmodic variation," found by him in the British Museum collection. In the present subspecies it amounts to almost as constant a character as the gular patch. It is not present, however, in a single specimen in an equal number of examples in this Museum from other localities.

*Tayra barbara irara* differs from typical *barbara*, from Venezuela and Brazil, in being very much smaller, apparently scarcely exceeding *Tayra barbara trinitatis* (Thomas) from the island of Trinidad, and dark chocolate brown instead of deep black. Two old males from Suapure, Venezuela, and other examples from Brazil, are intensely black throughout, except for the head and neck, and greatly exceed the Santa Marta specimens in size, the occipito-nasal length of the skull ranging from 118 to 126 mm., the basal length from 115 to 118, the zygomatic breadth from 70 to 79, and the upper toothrow from 24 to 26, against, respectively, 111, 106.9, 69, and 21.5 in *irara*.

Various names have been applied to the South American Tayras, but, as Mr. Thomas has noted (Ann. and Mag. Nat. Hist. (7), VII, Feb., 1901, p. 180), most of them are strict synonyms of *Mustela barbara* Linn. (1758), from "Brasilia." Apparently Linnæus described the animal from a specimen. He cites 'Ac. Holmens.', and Brown's 'History of Jamaica,' the last with a query. The former I am unable to consult. Brown's "Galera . . . The Guinea Fox," is based on an animal "often brought to Jamaica from the coasts of Guinea, where it is a native." In the 12th edition of the 'Syst. Nat.' only Brown is cited. As "Brasilia" is probably used in a general sense, it seems proper to consider the type region of *Tayra barbara* as Guiana. *Mustela gulina* Schinz (1821), and *Gulo canescens* Lichtenstein (1823, ex Illiger MS.) are merely new names for *Mustela barbara* Linn.; *Vivera* [sic] *poliocephalus*

[sic] Traill (1821) was based on a specimen "brought to England from Demerara," and is therefore also a synonym of *M. barbara* Linn.; the *Mustela barbara* var. *laira* F. Cuvier was also from Guiana. *Eira ilya* H. Smith (Nat. Libr., XV, 1842, 203) was based on a crude drawing, by Prince John of Nassau, in the Berlin Library, of an animal from Guiana, and hence requires no further consideration.

The forms of the group heretofore recognized are:

*Tayra barbara barbara* (Linn.). Guiana, Venezuela, and Brazil.

*Tayra barbara peruana* (Tschudi).<sup>1</sup> Peru, east of the Andes.

*Tayra barbara senex* (Thomas). Mexico.

*Tayra barbara biologicæ* (Thomas). Central America.

*Tayra barbara trinitatis* (Thomas). Trinidad.

*Tayra barbara brunnea* (Thomas). Western Bolivia.

*Tayra barbara irara* Allen (as above). Northeastern Colombia.

17. *Nasua narica* (Linn.). Seven specimens, March 11-16 and April 16. They are mostly only about two thirds grown, but two are young adults. These, male and female, measure, respectively: Total length, ♂ 1143, ♀ 980; tail vertebræ, ♂ 550, ♀ 475; hind foot, ♂ 105, ♀ 100. Skulls: Total length, ♂ 128, ♀ 122; zygomatic breadth, ♂ 60, ♀ 58. Old specimens would be much larger, especially in the cranial measurements, and particularly in zygomatic breadth.

<sup>1</sup> *Galictis barbara* TSCHUDI, Fauna Peruana, 1844-46, 107. Description based on a Peruvian specimen in captivity.

*Galictis barbara* var. *peruana* TSCHUDI, Wieg. Arch., 1844, i, 248. Based on the description in 'Fauna Peruana.'

In this description Tschudi states that, like many other mammals and birds common to Peru and Brazil, the Peruvian representatives are not quite the same as the Brazilian; although the color pattern is the same, the Peruvian animals are much more intensely colored; but he considers such differences local and climatic, and not really of specific value. He notes further that his description of what he here designates *Galictis barbara* does not agree altogether with Brazilian examples. In his 'Mammalium conspectus quæ in Republica Peruana reperiuntur et pleraque observata vel collecta sunt in itinere a Dr. J. J. de Tschudi' (Wieg. Arch., 1844, i, pp. 244-255, dated Dec., 1843), he appears to have decided to recognize the Peruvian form of this animal as a variety, referring to the 'Fauna Peruana' as the basis for the name. As no page or plate reference is given, in this as in other cases in the 'Conspectus' where new names appear, it is probable that the 'Fauna,' although in press, had not at that time appeared, and that the new names (17 in number) employed in the 'Conspectus' were nomina nuda until Volume I of the Fauna was published. This ('Therologie,' half-title, following p. xxx) is dated 1844; but there is internal evidence that it could not have appeared prior to July, 1845 (see p. 262, footnote). As in the interval between the publication of the 'Conspectus' and the mammal part of the 'Fauna' no other name was proposed for the Peruvian *Tayra*, it seems admissible to adopt *peruana* from Tschudi, as was done by Dr. Nehring in 1866 (Zool. Jahrb., 1886, i, p. 206).

All of the other new names in the 'Conspectus' appear also in the 'Fauna,' and their status is thus without question. This includes Tschudi's *Cervus nemorivagus* var. *peruana* (Conspectus, l. c., p. 255), which, while not adopted in the text (Fauna, p. 240), appears in the 'Systematische Zusammenstellung' on p. 20. This antedates by about ten years Wagner's *Cervus tschudii* (Schreber's Säugth., Suppl., V, 1855, pp. 386, 387), based wholly on Tschudi's description. The Peruvian Brocket will thus stand as *Mazama peruana* (TSCHUDI).

18. *Alouatta palliata mexicana* Merriam. Nineteen specimens, 16 adult and 3 nursing young, March 15 and April 8-19.

Four adult males and 6 adult females have external measurements as follows:

♂, Total length,	1142;	tailvertebræ,	585;	hind foot,	145.
♂, " " "	1140;	" " "	620;	" " "	153.
♂, " " "	1212;	" " "	635;	" " "	152.
♂, " " "	1115;	" " "	604;	" " "	153.
♀, " " "	1189;	" " "	661;	" " "	150.
♀, " " "	1123;	" " "	630;	" " "	148.
♀, " " "	1119;	" " "	605;	" " "	148.
♀, " " "	1110;	" " "	620;	" " "	146.
♀, " " "	1107;	" " "	618;	" " "	152.
♀, " " "	1100;	" " "	625;	" " "	148.

Eight adult skulls, 3 males and 5 females, measure: Basal length, (inner base of incisors to posterior border of occipital condyles), 3 males, 92.5 (90-96); zygomatic breadth, 80.5 (78.5-83): 5 females, basal length, 83.4 (81-87); zygomatic breadth, 70 (68-72).

Dr. Merriam, in separating this form (Proc. Biol. Soc. Wash., XV, p. 67, March 22, 1902), indicated the distinctive cranial features, but said nothing of the external differences, which prove to be equally striking. Compared with a series of seven specimens from Chiriqui, collected by Mr. Batty, the Mexican form proves to be much duller colored, with the flanks in the brightest specimens as obscurely colored as in the very palest of the Chiriqui examples, none of them presenting the golden rufous so characteristic of the latter. (See below, p. 80.) The sides of the back are yellowish gray washed with blackish, with the long hairs at the lower edge of the flanks dull yellowish gray with dull brownish tips, instead of rich golden with the tips almost golden chestnut.

The young in first pelage are dull, dingy gray, varied slightly with a wash of blackish, especially on the head, middle of the back, limbs, and tail.

19. *Ateles pan* Schlegel. Represented by 22 specimens, mostly adult, but including a few young adults, and one in first pelage, collected March 5-April 19.

Similar to *A. vellerosus*, but with little or no white on the sides of the head, and the inside of the arms and legs mostly black.

In *Ateles vellerosus* the inside of the arms down to the hands, and the whole inside of the thighs and the legs to the feet are broadly yellowish white. In *A. pan* there is a narrow whitish stripe on the inside of the shoulder, rapidly narrowing distally and rarely extending more than half-way to the elbow, the fore arm being black all around. The light color of the underparts extends down the inside of the thighs and hind legs, rapidly narrowing distally, usually about to the knees, but sometimes as a very narrow, indistinct light line to the feet, consisting often merely of scattered grayish hairs, but never forming a broad band as in *vellerosus*.

The whitish patch on the sides of the face is either almost wholly absent, or is represented by an indistinct cluster of whitish hairs opposite the angle of the mouth, but not extending up to the sides of the forehead, as in *vellerosus*.

*Measurements.*—The 7 largest males and the 7 largest females which have measurements (for several they are not given) measure as follows:

♂, Total length,	1310;	tail vertebrae,	832;	hind foot,	183.
♂, " " "	1275;	" " "	815;	" " "	191.
♂, " " "	1210;	" " "	670;	" " "	161.
♂, " " "	1197;	" " "	721;	" " "	172.
♂, " " "	1148;	" " "	820;	" " "	175.
♂, " " "	1142;	" " "	605;	" " "	175.
♂, " " "	1109;	" " "	706;	" " "	165.
♀, " " "	1250;	" " "	822;	" " "	180.
♀, " " "	1235;	" " "	820;	" " "	175.
♀, " " "	1232;	" " "	791;	" " "	174.
♀, " " "	1231;	" " "	792;	" " "	179.
♀, " " "	1160;	" " "	740;	" " "	170.
♀, " " "	1152;	" " "	770;	" " "	170.
♀, " " "	1150;	" " "	630;	" " "	163.

While the teeth show that these specimens are fully adult, the sutures and slight development of the temporal ridges indicate that the greater part are comparatively young or middle-aged adults. One male has the teeth greatly worn, and one female has them considerably worn. These measure, respectively, basal length, ♂ 88, ♀ 81; zygomatic breadth, ♂ 72, ♀ 62. The others grade smaller, according to age. A fully adult but not 'old' skull gives the following: Total length, 108; basal length (inner base of incisors to posterior border of occipital condyles), 77; zygomatic breadth, 64; mastoid breadth, 59; orbital breadth, 55; length of palate, 29; length of nasals (following curvature), 18; width of nasals, 8, at front margin, tapering to a point posteriorly; upper premolar-molar series, 25; length of lower jaw

(front of incisors to posterior border of condyles), 69; height at condyle, 38; height at coronoid process, same as at condyle; length of lower premolar-molar series, 27.5.

Adults of the same sex present a rather wide range of variation in color, wholly independent of sex or age. In the darkest specimens the head, neck, limbs, and tail are deep black; the shoulders and dorsal region are brownish black, the black being less intense and slightly suffused with a ruddy cast, becoming still paler and lighter on the posterior half of the dorsal region, especially on the loins, where the suffusion is paler and more yellowish; a narrow lateral line of dark yellowish rufous runs from the shoulders to the thighs; ventral surface yellowish gray, which color extends in a narrow line down the inside of the upper arm to the elbow, and down the inside of the thighs to a little below the knee, narrowing distally.

In the lightest examples the head, distal half of the limbs, and tail are dull black; the nape, shoulders, and the proximal half of the limbs and tail brownish black, with a strong dull yellowish red suffusion; the dorsal area posterior to the shoulders is dingy golden yellow, brightening on the sides to brilliant golden rufous, terminating abruptly against the lighter color of the ventral surface in a sharply limited lateral line of deep golden rufous, which is prolonged posteriorly over the upper part of the thighs and down the inner side of the hind legs to below the knees; ventral surface clear yellowish white. Between these is every stage of gradation.

In the lighter-colored specimens there is a striking similarity in the tints and in the pattern of coloration to *Alouatta palliata mexicana*, which occurs abundantly with it at Pasa Nueva, but the darker under surface of the latter readily distinguishes the two species without resort to other characters.

The single very young specimen in first pelage is very thinly haired, the ventral area being practically naked. The whole dorsal area, limbs, and tail are uniform blackish.

The type of *Ateles vellerosus* Gray (P. Z. S., 1865, p. 733; Cat. Monkeys, etc., 1870, p. 44) was supposed by the describer to have come from Brazil, but later Alston (Biol. Centr.-Am., Mamm., 1879, p. 10) considered it identical with specimens from Central America. In the meantime Sclater figured under this name (P. Z. S., 1872, p. 4, pl. ii) a specimen believed to have been procured near Acapulco, Mexico, which he considered as indistinguishable from Gray's type. The authenticity of this locality was soon after questioned by Reinhardt (P. Z. S., 1872, p. 797), who, however, referred specimens to *vellosus* from Mirador, Vera Cruz, "although the yellowish



colour on the inside of the hind limbs does not extend so far down to the hands" as in Sclater's specimen, "and the whiskers offer only a faint trace of the whitish colour which encircles the face" of *vellerosus*. Reinhardt says of his Mexican specimen: "I have hitherto considered it a new species and given it a provisional name"; but he appears to have never published this provisional name. But Schlegel's *Ateles pan* (Mus. Pays-Bas, VII, 1876, p. 180), from near Coban, Guatemala, appears to have been based on specimens very similar to those of the present series from Vera Cruz. He compares his specimens with his "*Ateles fuliginosus* Kuhl" (= *A. vellerosus* Gray), and refers especially to the absence of the light color on the forearms and on the posterior extremities. The present series is therefore referred provisionally to Schlegel's *Ateles pan*, to which a single specimen collected by Dr. Buller at Chimalapa, Tehuantepec, formerly identified with *Ateles vellerosus* (this Bulletin, III, 1890, p. 176), is also referable.

## II. — CENTRAL COSTA RICA.

The collection here under notice was made for the Museum by Mr. M. A. Carriker, Jr., during the period from February to July, 1902, mostly in or near the Irazu Range in central Costa Rica. The collection numbers about 120 specimens, referable to 23 species. The principal localities at which collections were made are "Mount Irazu," Feb. 23 to April 21, part of the specimens (collected Feb. 23 to March 6) being labeled simply "Mount Irazu"; a part (collected March 13-22), "Juan Viñas, Mount Irazu" (altitude 1113 meters); and others (collected April 2-21), "Rancho de R. Jimenez" (altitude about 1100 meters). Later, specimens were collected at "Pozo Azul, Pirris Province" (May 14-26 and July 1-23), at San José (July 21), and at San Pedro, near San José (July 29). Pozo Azul is on the Pacific slope, at an altitude of about 200 meters.

1. ***Caluromys laniger pallidus* (Thomas).** One specimen, female, San José, July 21.

This specimen is gray, with a pale brownish tinge over the shoulders and on the middle of the back, but wholly lacks the usual gray shoulder stripe of the *laniger* group. It therefore agrees very closely with what may be regarded as the average condition of *C. l. pallidus*, judging from Mr. Thomas's description. The specimen is a full-grown female, and measures as follows: Total length, 665; tail vertebræ, 405; hind foot, 40.5.

2. ***Metachirus fuscogriseus* Allen.** Four skins and skulls of two-thirds grown specimens, and an adult skull, from Juan Viñas, March 14-16.

3. ***Didelphis marsupialis etensis* Allen.** One skin, without skull, Pozo Azul, May 26.

4. ***Mazama satorii* (Saussure).** One specimen, a young male, Pozo Azul, July.

5. ***Sciurus (Echinosciurus) thomasi* Nelson.** One specimen, an old male, Pozo Azul, March 14. Total length, 460; tail vertebræ, 230; hind foot, 59.

6. ***Sciurus (Guerlinguetus) hoffmanni* (Peters).** Ten specimens, all adult, collected as follows: Volcan de Irazu, 5, Feb. 24 and March 2-5; Rancho de R. Jimenez, 3, April 5-8; Pozo Azul, 2, June 18.

These specimens vary greatly in color, especially the ventral surface, and are fairly separable into two series, those with orange-yellow bellies and those with reddish orange bellies, there being four of the former and six of the latter. As, however, specimens of each were taken the same day at the same locality, and each series includes both sexes, the variation is evidently purely individual. The upper surface varies correspondingly, as does the tail, in which the color of the fringe varies from yellow (one specimen) to deep reddish orange.

These specimens, taken collectively as a series, do not differ appreciably from a series of 14 examples from Chiriqui, Panama, or from specimens from other localities in Costa Rica, in which pale-bellied specimens are also more or less frequent.

The collector's measurements of 4 males and 3 females are as follows:

♂, Total length,	420;	tail vertebræ,	215;	hind foot,	55.
♂, " " "	393;	" " "	190;	" " "	55.
♂, " " "	382;	" " "	180;	" " "	55.
♂, " " "	375;	" " "	167;	" " "	51.
♀, " " "	405;	" " "	198;	" " "	57.
♀, " " "	380;	" " "	173;	" " "	51.
♀, " " "	385;	" " "	172;	" " "	55.

7. **Mus musculus** *Linnaeus*. Three specimens, Volcan de Irazu, Feb. 23 and March 3.

8. **Mus rattus** *Linnaeus*. Three specimens, Juan Viñas, March 14-16.

9. **Peromyscus nudipes** (*Allen*). Nineteen specimens, Rancho de R. Jimenez, Juan Viñas, and other neighboring points in the Irazu Range, Feb. 25-April 4. (For measurements, etc., see below, p. 68.)

10. **Oryzomys devius** *Bangs*. Two old adults, Volcan de Irazu, March 4.

These specimens are in heavier pelage and rather more deeply colored than topotypes of *O. devius* from Boquete, Chiriqui, and are also older, but on the whole agree so well with them, especially in cranial characters, that they are provisionally referred here.

11. **Oryzomys couesi** (*Alston*). One specimen, adult female, Rancho de R. Jimenez, Volcan de Irazu, April 13.

12. **Reithrodontomys costaricensis** *Allen*. Ten specimens, 6 adults and 4 young, San Pedro, June 29. The adults measure: Total length, 189 (182-205); tail vertebræ, 112 (103-121); hind foot, 20.3 (19.5-20.5). The young specimens, two-thirds grown, resemble in coloration an average example of *Mus musculus*, excepting a tinge of bright rufous on the head, shoulders, and flanks, due to the incoming of the adult coloration.

13. **Reithrodontomys australis** *Allen*. Twenty-five speci-

mens (topotypes), Volcan de Irazu, Feb. 23 and 24, and March 1-6.

Nine adult males: Total length, 163 (155-174); tail vertebræ, 86 (83-96); hind foot, 19 (18-20). The largest specimen of the series is a female, the collector's measurements being: 185, 96, 20. As this species was described from a single skin and skull from Volcan de Irazu, this series of topotypes with flesh measurements helps to complete the description. The type proves to represent the adult condition of the species.

#### 14. *Akodon irazu*, sp. nov.

Type, No. 18128, ♀ ad., Volcan de Irazu, Feb. 23, 1902; M. A. Carriker, Jr.

Smaller, with relatively smaller ears, than either *Akodon teguina* or *A. xerampelinus* Bangs, with the upper parts lighter and more yellowish brown, and the under parts buffy brown instead of cinnamon brown. *A. teguina* is even darker and more blackish than *A. t. apricus*.

Total length (type), 125; tail vertebræ, 50; hind foot, 17. The type is an old female with the teeth much worn. Six adult topotypes: Total length, 132 (121-140); tail vertebræ, 51 (50-53); hind foot, 17.3 (17-19).

Skull (type), occipito-nasal length, 22; basal length of Hensel, 17; zygomatic breadth, 11.5; mastoid breadth, 10; interorbital breadth, 4; length of nasals, 8.3; palatal length, 8; upper toothrow, 4; lower jaw, condyle to base of incisors, 11.

Represented by 8 specimens, collected on the Volcan de Irazu, Feb. 23 and 24, and March 3-6.

This species is readily distinguished from its nearest allies by its smaller size and paler coloration, as indicated above.

#### 15. *Macrogeomys heterodus* (Peters). One specimen, Sabanilla, near San José, July 2.

Total length, 228; tail vertebræ, 58; hind foot, 37. General coloration above, very dark seal brown, with scattered, long, bristly, whitish hairs, most numerous and rather conspicuous on the sides; no white mark on the head; lower parts soiled grayish white, sharply defined against the dark color of the dorsal surface; tail short, naked; feet nearly naked, apparently brownish flesh color in life; claws short and weak, in comparison with those of *M. cherriei* and allied forms.

#### 16. *Lepus* (Tapeti) *gabbi* (Allen). Three specimens,—two

from Rancho de R. Jimenez, April 21, and one from Juan Viñas, March 22.

17. *Felis carrikeri*, sp. nov.

Type, No. 19211, ♀ ad., Pozo Azul, Pirris Province, Costa Rica, May 14, 1902; A. M. Carriker, Jr., for whom the species is named.

A small, short-tailed cat, with full, soft pelage. Above, from the nose to the end of the tail, brownish black, quite black over the whole dorsal area, lighter and browner on the lower border of the sides, passing gradually into the very dark chocolate brown of the ventral surface; outside of limbs very dark chocolate brown, irregularly and rather indistinctly clouded with blackish brown; inside of limbs like the ventral surface, indistinctly blotched with darker spots; ears externally blackish brown, like the top of the head; lips and cheeks uniform blackish, like the rest of the head; tail above uniform brownish black, like the middle of the back, lighter and slightly clouded with darker on the sides and below.

*Measurements.* — Total length, 970; tail vertebræ, 276; hind foot, 101. Skull, total length, 86; basal length of Hensel, 73; zygomatic breadth, 55; least interorbital breadth, 16; intertemporal breadth, 28; width of braincase above meatus auditorius, 38; length of nasal bones, 18; breadth of nasal bones across anterior border, 11; do. opposite nasal process of frontals, 6.2; audital bulla, 18 x 10; breadth at posterior end of carnassials, 30.5; front of canine to posterior border of carnassial, 25; length of upper carnassial, 10; length of lower carnassial, 7.5; length of lower jaw (front base of incisors to end of angular process), 55; height of jaw at condyle, 11.5; do. at coronoid, 21.5.

Contour and proportions of the skull as in *Felis apache* and *Felis fossata* Mearns (Proc. Biol. Soc. Wash., XIV, pp. 149-151, August 9, 1901), but smaller and lacking the nasal fossa of the latter, in this respect agreeing with *F. apache*. The skull here described is that of an adult (middle-aged) female.

The dark coloration of the type specimen and the obscure spotting on the limbs suggests a melanism of some form of the *F. pardalis* group, or that it may be, normally, a short-tailed spotted cat. Its small size, as affirmed by the size and age conditions of the skull, renders it, however, impracticable to refer it to any of the known forms of the *pardalis* group, the smallest of which enormously exceeds in size the type of *Felis carrikeri*. On the other hand, the skull agrees very closely in size with the smallest of the small-headed, long-tailed spotted cats of South America, but the shortness of the

tail separates it from this group and allies it, in proportions, with the *Felis eyra* group, of which it appears to be a small, dark form.

18. ***Urocyon guatemalæ* Miller.** Two specimens, an adult female and a two-thirds grown male, from Pozo Azul, July 17.

The adult female agrees very closely in size, cranial characters, and coloration with topotypes of Mr. Miller's *U. guatemalæ*, except that the whole dorsal area is much blacker, and the ears, sides of the neck, outer edges of the limbs, and under surface of the tail are darker, being ochraceous brown instead of "tawny ochraceous." On the back the black tips of the hairs are so long and abundant that the prevailing color of the middle portion of the back is black. The audital bullæ are also less inflated. Probably additional material would show the desirability of recognizing the Costa Rican animal as sub-specifically separable from *U. guatemalæ*.

19. ***Conepatus (Marpotius) marpurito* (Gmelin).** Two specimens, an adult female from Pozo Azul, June 6, and a young male from Rancho de R. Jimenez, April 21. Female, total length, 610; tail vertebræ, 175; hind foot, 49.

These specimens are very different from *C. tropicalis*, from the eastern coast of Mexico, both in coloration and in the form of the skull. In the absence of Colombian specimens of true *C. marpurito*, they are provisionally referred to it on the basis of Mr. Thomas's statement (Ann. and Mag. Nat. Hist. (7), V, June, 1900, p. 500) that "true *C. marpurito* . . . occurs at Bogota and north-westwards into Central America."

20. ***Nasua narica bullata*, subsp. nov.**

FIGURE 10.

Type, No. 19210, ♂ ad., Pozo Azul, Pirris Province, Costa Rica, June 23, 1902; A. M. Carriker, Jr.

General color very dark throughout, much darker than in any of the Mexican forms, with large, greatly inflated bullæ, and small teeth in comparison with *N. n. molaris* Merriam.

General color dark brown. In the type the whole head, except the ears and usual light facial areas, is brownish black, the feet deep black,

the middle of the dorsal region deep brownish black, with the hairs tipped yellowish, the sides dark brown, and the ventral surface dark brown with the tips of the hairs lighter; throat and chest soiled whitish; tail dark brown above, lighter on the sides and below, darkening



Fig. 10. *Nasua narica bullata*. No. 19210, ♂ ad. Type.  $\frac{1}{2}$  nat. size.

to nearly black towards the tip. The type is in rather worn pelage, with the new coat coming in. Another specimen (U. S. Nat. Mus. No.  $\frac{121194}{14194}$ , Talamanca) in full fresh pelage is less dark, the head being dark yellowish brown, the feet dark brown, and the long hair over the shoul-



Fig. 11. *Nasua narica molaris*. No. 6676, ♂ ad. San Felipe de Hijas, Jalisco, Mexico.  $\frac{1}{2}$  nat. size. For comparison with Fig. 10.

ders and anterior part of the dorsal region with long, rich, yellowish brown tips; chin yellowish white; chest with the basal half of the pelage rusty brown and the tips of the hairs pale yellowish.

*Measurements.* — Total length (type, ♂), 1119; tail vertebrae, 587; hind foot, 133. Skull, occipito-nasal length, 140; basal length of February, 1904.]

Hensel, 123; zygomatic breadth, 78; interorbital breadth, 28; width of braincase, 45; length of upper molar series, 21.5; length of lower molar series, 26; audital bulla, 17 x 11; height of sagittal crest, 6. Another specimen, probably male, occipito-nasal length, 146; basal length, 128; zygomatic breadth, 81; interorbital breadth, 31; width of braincase, 47; length of upper molar series, 22.5; length of lower molar series, 25; audital bulla, 17 x 12; height of sagittal crest, 8. Still another specimen, apparently female, occipito-nasal length, 137; basal length, 120; zygomatic breadth, 82; interorbital breadth, 33; width of braincase, 49; length of upper molar series, 22; audital bulla, 16 x 12; height of sagittal crest, 5. These skulls, while apparently old, with closed sutures and highly developed crests, have the teeth very little worn.

The Costa Rica and Panama Coatis differ from those of Mexico in their very much darker coloration, and in the greatly increased size and more elongated form of the audital bullæ, which are one-fifth longer than in an old male of *N. n. molaris* from southern Jalisco, and nearly twice the size of those of true *N. narica* from eastern Mexico. Compared with *molaris* of equal age and the same sex, the skull is longer and narrower, the zygomatic breadth being 4 mm. less, and the zygomatic arch is much more strongly curved upward; the dental armature is heavier than in Vera Cruz specimens of true *narica*, but far less developed than in *molaris* (Fig. 11). Two additional specimens from Talamanca, Costa Rica (U. S. Nat. Mus. Nos.  $\frac{12193}{14193}$  and  $\frac{12194}{14194}$ ) agree in cranial characters with the type.

Apparently Linnæus based (Syst. Nat., 1766, I, p. 64) his *Viverra nasua* wholly on Brisson's *Le Coati-Mondi* (Règne Animal, 1, 1756, p. 262), for which Brisson gave no locality, but took his description from a specimen he saw in the possession of Mr. Lievre. The species was described by Buffon in 1760 as *Le Coati brun*, from a specimen he had alive, but he gave no indication of its original source. Linnæus gave the habitat as "America."<sup>1</sup> There is no doubt, however, that both Brisson's and Buffon's specimens came from eastern

<sup>1</sup> In my paper 'On the Coatis (Genus *Nasua*, Storr),' published in 1879 (Bull. U. S. Geogr. and Geolog. Surv. Territories, V, No. 2, Sept., 1879, pp. 153-174), I inadvertently stated (*l. c.*, pp. 162, 166) that *Viverra nasua* Linn. was based entirely on Buffon, Buffon being a lapsus for Brisson.



Mexico, and the State of Vera Cruz may be considered as the type region of the species.<sup>1</sup>

The later names given to the Mexican species must be treated as synonyms of *N. narica*, none of them being distinguishable from it by any of the assigned characters or localities.

The material available for examination shows that the Coatis from widely separated localities in Mexico and Central America vary greatly in general coloration and size, in the relative size of the teeth, and in the size and shape of the audital bullæ, which variations form a basis for the separation of the group into a considerable number of geographical forms, in addition to those already recognized.<sup>2</sup> Several are here indicated, as follows:

***Nasua narica panamensis*, subsp. nov.**

FIGURE 12.

Type, No. 18901, ♀ ad., Boqueron, Chiriqui, Oct. 29, 1901; J. H. Batty.

In coloration not readily distinguishable from *N. narica bullata*, being very dark and highly colored, but much smaller, and with the bullæ of the usual size for the *narica* group. Top of head, nape, and

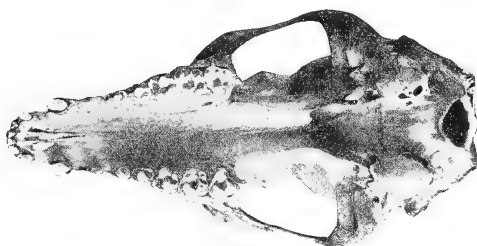


Fig. 12. *Nasua narica panamensis*. No. 18901, ♀ ad. Type.  $\frac{1}{2}$  nat. size.

shoulders rusty brown; anterior half of back yellowish gray brown, darkening on the posterior half of the back and rump to dusky brown, the hairs tipped with yellowish gray; ears and sides of shoulders yellowish white; feet and tail dark brown, the latter darkening apically.

<sup>1</sup> For a discussion of the synonymy and geographical distribution of the species of *Nasua* see the paper cited in the preceding footnote.

<sup>2</sup> *Nasua nelsoni* Merriam. Cozumel Island, Yucatan.

*Nasua narica* (Linn.). Southeastern Mexico.

*Nasua narica molaris* Merriam. Southwestern Mexico.

*Nasua narica bullata* Allen (as above). Costa Rica.

*Measurements*. — Total length (type, ♀), 1080; head and body, 540; tail vertebræ, 540; hind foot, 116; ear, 40. Skull, occipito-nasal length, 122; basal length of Hensel, 108; zygomatic breadth, 60; interorbital breadth, 25; width of braincase, 44.5; length of upper molar series, 21; audital bulla, 13 x 9.5. Another female (No. 10125, Bangs Coll.), from Boquete, is slightly smaller. Both are middle-aged adults, with undeveloped crests, and the sutures of the rostral portion of the skull still well-defined. Another specimen (No. 10123, Bangs Coll.), sex not indicated, but apparently a male, very old, with closed sutures and well developed sagittal and occipital crests, is rather larger than the type, the occipito-nasal length being 130; the basal length, 112; the zygomatic breadth, 77; the audital bulla, 13 x 9.5; sagittal crest, 6.

*N. narica panamensis* probably differs very little in average coloration from *N. n. bullata*, both forms presenting the usual wide individual range of color-variation seen in all the forms of *Nasua*, but it is apparently very much smaller, with the audital bullæ nearly one half less. From *N. narica* it differs markedly through its much darker general coloration, and still more so in this respect from the forms of the more arid portions of Mexico.

#### ***Nasua narica yucatanica*, subsp. nov.**

Type, No.  $\frac{12037}{10138}$ , ♂ ad., Chichenitza, Yucatan, March 11, 1896; Frank M. Chapman.

General color above, including the tail, pale brownish yellow; hairs of the upper surface, individually, ochraceous buff, with the tips slightly brownish over the hinder portion of the dorsal region, and yellowish white on the shoulders; sides of shoulders, sides of neck, and proximal two-thirds of fore limbs pale cream color, the light tips of the hairs very long; ventral surface pale reddish brown, with the tips of the hairs whitish; the dark areas on the face and the fore and hind feet dark chocolate brown; tail all around pale buff, darker and slightly browner at the tip.

*Measurements*. — Total length, 1150; tail vertebræ, 550; hind foot, 100. Skull (very old male), occipito-nasal length, 130; basal length (inner base of incisors to posterior border of condyles), 120; zygomatic breadth, 77; interorbital breadth, 29; width of braincase, 43; length of upper molar series, 18; length of lower molar series, 23.3; height of sagittal crest, 6.5; audital bulla, 14.6 x 10.

*Nasua narica yucatanica* is a small, pale form, from the arid districts of Yucatan. While it considerably exceeds in size the

very small *Nasua nelsoni* from Cozumel Island, it is much smaller than *N. narica* from eastern Mexico, and much paler, more yellow even, than specimens from southern Chihuahua. At first sight the type looks like a bleached specimen, but proves on examination to be in excellent, unworn pelage. The skull shows that the specimen was very old (the upper teeth are more or less defective from caries, but are not greatly worn). The general form of the skull is narrow, and the teeth are very small even for the small size of the skull, the three posterior upper molariform teeth having a length of 18 mm. against 21 mm. in *N. narica* from the State of Vera Cruz, and they are even more reduced in general size, the last upper molar having a transverse diameter of 6 mm. against 7.6 mm. in *narica*. The palatal region is very narrow, especially the portion posterior to the molars, where the least width is 15.5 mm. as compared with 19 mm. for the same measurement in *narica*.

Since writing the above I have received, through Mr. Gerrit S. Miller, Jr., in charge of mammals at the U. S. National Museum, a specimen of Coati from Brownsville, Texas, collected by the late Dr. J. C. Merrill, that agrees strikingly in coloration and small size with the specimen from Yucatan, it having the same dull, yellowish underfur, rusty yellow head, the long, yellowish gray tips to the hairs of the dorsal surface, and the very light underparts. Without further material it would be rash to attempt to separate subspecifically the Rio Grande and Yucatan Coatis.

In my paper on the genus *Nasua*, published in 1879 (*l. c.*, p. 163), I referred at length to this Brownsville specimen, in commenting on the wide range of geographical variation in the Coatis of Mexico and Central America, "the Mexican specimens being much lighter-colored than those from Guatemala and Costa Rica," etc.

***Nasua narica pallida*, subsp. nov.**

Type, No. 7125, adult, skin without skull, Sierra Nevada (vicinity of Guadalupe y Calva), Chihuahua, Mexico; Dr. Carl Lumholtz.

General color above pale brown, the hairs for their basal three-

fourths pale buff or buffy white, then broadly ringed with dark brown and broadly tipped with pale yellowish; top of head and nape pale yellowish brown; inner surface of ears, the light facial markings, sides of neck, sides of shoulders, and proximal two-thirds of fore limbs white; tail very pale brownish yellow, a little darker on the terminal fifth; ventral surface and flanks lighter than the back; feet dark brown; dark facial markings pale chocolate brown.

*Measurements.* — Total length (approximate, from a flat skin, probably stretched), 1200; tail vertebræ, 515. (There is no skull.)

Based on 5 flat skins (hunter's pelts), obtained by Dr. Lumholtz in the vicinity of Guadalupe y Calva, southeastern Chihuahua, in 1892. While very unsatisfactory material, they suffice to show the existence of a pallid form of Coati in this arid region. These five skins vary considerably in color, individually, as Coatis usually do, but agree in the essential feature of excessive pallor, as compared with specimens from southern Sinaloa, Jalisco, and eastern Mexico. The general character of the coloration, however, is quite different from that of the pallid form from Yucatan and Brownsville, Texas.

21. *Ateles geoffroyi* (*Kuhl*). Five specimens (2 males, 3 females, all adult), Pozo Azul, June 13-15 and July 5.

The color of the upper parts varies from deep chestnut rufous to pale brownish rufous, more or less suffused with yellow, especially over the shoulders and anterior half of the back; the lower surface is deep rich rufous in all, varying somewhat in intensity in different specimens.

The collector's measurements are as follows:

♂,	Total length,	1520;	tail vertebræ,	950;	hind foot,	170.
♂, yg. ad.	"	1160;	"	675;	"	165.
♀,	"	1320;	"	824;	"	—.
♀,	"	1250;	"	785;	"	172.
♀,	"	1207;	"	737;	"	178.

The two oldest skulls measure, respectively: Basal length, ♂ 81, ♀ 82; zygomatic breadth, ♂ 67, ♀ 67.5.

22. *Cebus hypoleucus* (*Humboldt*). Five specimens, 2 males and 3 females, all adult, Pozo Azul, June 15 and 23 and July 4.

One of the females has elongated brownish hairs on the frontal region (*Cebus imitator* Thomas), while in other cases the males and females are alike in having the hairs of this region of the same length and color in both sexes.

23. **Saimiri oerstedii** (*Reinhardt*). Five specimens, Pozo Azul, Perris Province, May 31 and July 3, adult and young. In the young the cap is gray washed with black, the middle dorsal region is dull yellowish with a wash of dusky gray, and the feet are yellowish gray. In the young adults the middle of the back is more or less strongly varied with black, and the cap is blackish instead of deep black as in the adults.

### III. — CHIRIQUI, REPUBLIC OF PANAMA.

This collection was made by Mr. J. H. Batty, during the years 1900 and 1901, mainly at or near Boqueron and Boquete, in the Province of Chiriqui, but it also includes specimens from Coiba and other islands off the coast. The collection originally included over one thousand specimens, and contained very large series of all the more common species, such as the Monkeys (three species), Sloths, Anteaters, the large Opossum (*Didelphis*), Spiny Rat, Agoutis, Squirrels, etc., all of which I had an opportunity carefully to examine. Owing to the small amount of funds available for the purchase of such material, care was taken to select from the larger series such specimens as would best show the range of seasonal and individual variation.

It so happened that Mr. Outram Bangs's collector, Mr. W. W. Brown, and Mr. Batty were working in Chiriqui at the same time, and both collected in part at the same localities, but Mr. Brown covered a wider field and did some collecting at much higher altitudes than were visited by Mr. Batty. Mr. Batty, however, had not completed his work, and on leaving for a short visit to New York, the disturbed state of the country prevented his returning to resume it, so that he had to abandon a large number of specimens collected by his native assistants after he left.

A comparison of the present list with Mr. Bangs's excellent

report (Bull. Mus. Comp. Zoölogy, XXXIX, No. 2, April, 1902, pp. 17-51) on Mr. Brown's collection shows that Mr. Brown secured a number of species that were not obtained by Mr. Batty, but they came from altitudes far above the latter's field of work, who did not collect above 5000 feet, while Mr. Brown explored the Volcan de Chiriqui to above 10,000 feet.

Mr. Batty's collection numbers 52 species, all but four of which are from Chiriqui, the others being from Coiba Island.

1. **Marmosa murina mexicana** Merriam. Two specimens, Boqueron, Oct. 6 and 31.

2. **Caluromys laniger pallidus** (Thomas). Six specimens, all adult: Boqueron, 3, Oct. 25 and Dec. 5; La Parida Island, 3, Nov. 19 and 27.

In coloration these specimens strongly approach *C. l. derbianus*, and are very different from Mr. Thomas's description of his *C. l. pallidus*, of which he says: "General color pale grey throughout, extreme examples being almost white all over, but in other specimens the shoulders, sides of neck, and the middle dorsal region are pale rufous, with an indistinct trace of the grey stripe of *Ph. l. derbianus*." No two of the Chiriqui specimens are alike in coloration; all but one distinctly show the pale gray median stripe over the shoulders seen in *derbianus*, but with varying distinctness, from very clear and strong to subobsolete, while the sides of the neck and shoulders and the middle dorsal region are rufous, varying in different specimens from light, clear rufous to dark, almost chestnut rufous. The other specimen (one of the Parida Island series) has the whole upper parts bright, nearly uniform rufous, even to the proximal half of the fore legs and the entire hind legs, with no trace of the gray stripe on the shoulders. A Costa Rica specimen, from the Irazu Range, is gray with a tinge of rufous on sides of neck, shoulders, and mid-dorsal region, and with a gray stripe over the shoulders. A San José specimen is similar except in lacking the gray shoulder-stripe. A third Costa Rica specimen, from Boruca, has the greater part of the dorsal region light rufous, and merely a trace of the gray shoulder-stripe. None of these

specimens agrees with what I take to be true *derbianus*, represented by four specimens from the Rio Cauqueta, in the Cauca region of Colombia, which have the greater part of the dorsal aspect of the body, and also the limbs, intense light rufous, with a broad, very sharply defined gray shoulder-stripe.

While I provisionally refer the Chiriqui and Costa Rica specimens to *pallidus*, they certainly show that the form is subject to a wide range of individual variation in color, and that the supposed light color and absence of a gray shoulder-stripe fail as distinctive characters of this form.

The Chiriqui specimens are all old adults, as shown by the skull. The external measurements, taken from the collector's labels, are as follows: 3 males, total length, 763 (730-800); head and body, 300 (270-320); tail vertebræ, 463 (450-480); hind foot (without claws), 43 (40-45); ear (from notch), 41 (38-45). Three females: Total length, 740 (725-765); head and body, 285 (280-290); tail vertebræ, 458 (435-480); hind foot, 43 (40-44); ear, 39 (38-40).

The largest male skull measures 64 x 36, the average of the males being about 61 x 35, or the same as the type of *pallidus*. The external measurements, however, are greater, particularly the length of the tail, than those given by Mr. Thomas for the type.<sup>1</sup>

There is much less sexual difference in size than occurs in the *Didelphis* group.

3. *Metachirus fuscogriseus* Allen. Six specimens: Boqueron, 5, Oct. 30 and 31, and Nov. 30; locality not given, 1. This latter is a small, very pale female, in worn pelage.

Two very old males (Nos. 18904 and 18907) measure as follows: Total length, 640, 640; head and body, 350, 310; tail vertebræ, 290, 330; hind foot, 47.5, 50; ear, 37.5, 35. Two very old females (Nos. 18903, 18906): 610, 540; 310, 280; 300, 260; 45, 50; 40, 31. The two old male skulls measure, respectively: Total length, 80, 75; zygomatic breadth, 41.5, 41.5; an old female skull, 78 x 40. The sagittal and occipital crests are greatly developed and the teeth are much worn in all three.

<sup>1</sup> Mr. Thomas gives the total length of the type as 587 mm., obviously an error for 687.

The Boqueron specimens agree well with the type of *M. fuscogriseus*, which, however, proves to have been a young adult that had not reached full size. The males have a patch (probably glandular) of pale greenish yellow on each side of the flanks just in front of the thighs; in the females the fur around the edge of the pouch, and also lining it, is bright rusty chestnut.

4. *Didelphis marsupialis etensis* Allen. Six specimens, 4 adult and 2 young, Boqueron, August to December. Selected from a large series. (For measurements see this Bulletin, XVI, 1902, p. 277.)

5. *Didelphis marsupialis battyi* Thomas. One specimen, male, Coiba Island (a topotype), May 2. (For remarks on the Coiba series of *Didelphis* see this

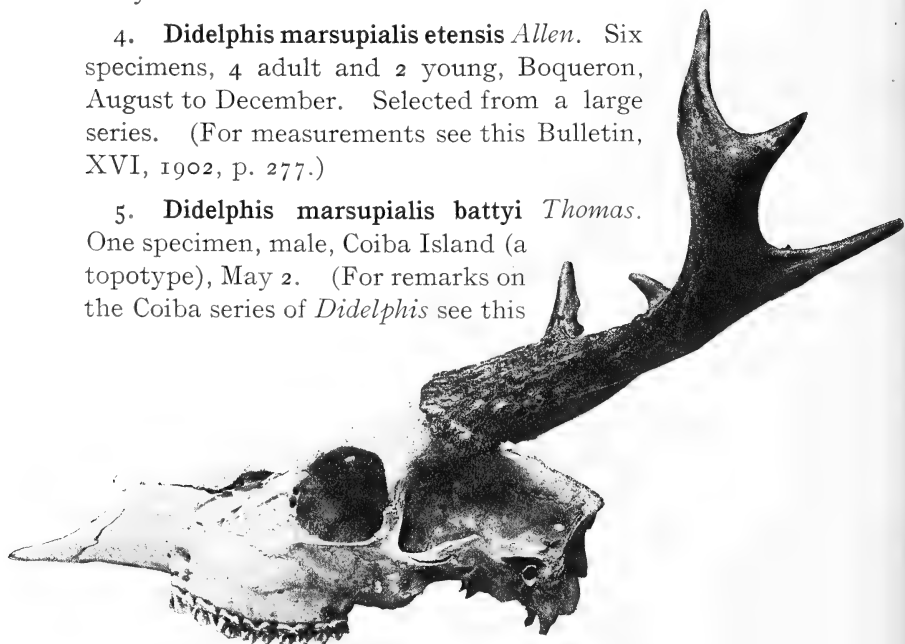


Fig. 13. *Odocoileus rothschildi*. No. 18951, ♂ old ad., Coiba Island, Panama.  $\frac{1}{3}$  nat. size.

Bulletin, XVI, 1902, pp. 264, 265, and for measurements of the series see *ibid.*, p. 278.)

6. *Cholœpus hoffmanni* Peters. Five adults and 3 young, as follows, selected from a large series: Parida Island, 1 adult male, Nov. 22; Boquete, 1 adult female, Sept. 14; Boqueron, 1 adult male, 2 adult females, and 3 young, Oct. 13-24, Nov. 22, and Dec. 1.

Mr. Batty's large series of some 50 specimens shows a wide range of individual variation in color, some being much lighter



or darker than the average; some have a strong greenish tinge over the whole head and shoulders, while others show no greenish tinge whatever.

7. *Cyclopes dorsalis* (Gray). One specimen, adult female, Boqueron, Oct. 19. Total length, 422; head and body, 195; tail vertebræ, 227; hind foot, 30; ear, 15.



Fig. 14. *Odocoileus rothschildi*. Same skull as Fig. 13.  $\frac{1}{3}$  nat. size.

8. *Tamandua tetradactyla* (Linn.). Four specimens, all females: Boqueron, 3, Oct. 16 and Nov. 26 and 27; Boquete, 1, Aug. 28. Selected from a large series, showing very wide individual variation in color. The light areas vary from nearly clear white to pale yellowish brown, and the dark areas from brown-black to deep clear black.

The three Boqueron specimens (females), measure respectively: Total length, 1165, 1240, 1120; head and body, 610, 580, 540; tail, 555, 600, 580; hind foot (without claws), 90, 100, 90; ear, 45, 50, 40.

9. **Tatu novemcinctus** (Linn.). Three specimens, Boqueron, Oct. 14-26. Total length, ♂ 735, ♀ 680; head and body, ♂ 365, ♀ 340; tail, ♂ 370, ♀ 340; hind foot (without claws), ♂ 70, ♀ 70; ear, ♂ 40, ♀ 37.5. Each has 10 free bands.

*Dasypus novemcinctus* Linn. was based primarily on references to the South American animal. In case the Central American and Mexican representatives prove separable from true *novemcinctus* there are already several names for them, as *Dasypus fenestratus* Peters (1864, Guatemala), *D. novemcinctus* var. *mexicana* Peters (1864, Mexico), and *Tatusia leptorhyncha* Gray (1873, Guatemala).

10. **Odocoileus rothschildi** (Thomas). Seven specimens, topotypes, from Coiba Island, consisting of 3 adult males, 2 adult females, and 2 young in spotted coat, collected May 10 to June 15. (Figs. 13-15, pp. 58, 59, 62.)

The three males, though adult, vary greatly in size and in the development of the antlers, and show that Mr. Thomas's two specimens on which he based the species were young or undersized adults. As regards the external characters, there is little to add to Mr. Thomas's description, except that the upper surface of the tail in most of these examples is dark reddish brown above instead of "fawn." The ears in most of the specimens are externally nearly naked.

*Young, in spotted coat.* — Above, deep yellowish rusty brown, darker along the median line, forming a well-defined dorsal stripe to a point considerably behind the middle of the back; sides lighter and more yellowish; whole dorsal surface thickly spotted with white, with a tendency to a linear arrangement of the spots; they form two distinct median parallel lines (one on each side of the middle of the back), and the spots are more or less in lines elsewhere; white of under parts and other markings as in the adults.

Mr. Batty has given me the measurements of 10 adults of this species, taken in the flesh, but owing to his omission to number some

of the specimens they cannot be satisfactorily correlated with the specimens. Of these 10 "adults," 7 are males and 3 are females, but evidently they are not of equal age, probably including young and middle-aged animals as well as some old adults.

*External Measurements.*

	♂	♂	♂	♂	♂	♂	♀	♀	♀
Head and body...	2591	2438	2388	2311	2197	2159	2236	2184	2083
Tail.....	311	215	254	311	305	305	229	229	229
Hind foot .....	241	235	—	—	—	203	221	191	203
Ear, from base....	254	235	254	241	241	241	254	241	210

The male skulls measure as follows, in comparison with those of the type of the species as given by Mr. Thomas.

*Measurements of Six Skulls.*

	Type.	No. 18951	No. 18949	No. 18953	No. 18955	No. 18950
	♂	♂	♂	♂	♀	♀
Greatest length.....	201	222	207	211	194	192
Basal length (bas. to gnath.)	180	200	189	189	172	170
Greatest breadth.....	86.5	88	88	90	84	79
Nasals, length.....	64	65	65	70	59	64
“ breadth.....	22.5	23	24	23.5	21.3	18.5
Muzzle to orbit.....	103	112	109	111	102	104
Breadth of braincase.....	58	60	55.5	58.6	54.5	55.5
Muzzle to anterior premolar	61	65	62	62	55	56.
Alv. length of upper toothrow	57	66	62	64	58.3	63
Crown “ “ “ “	60	65	63	65	61	65
Alv. length of lower toothrow	65	71	68.7	70	66	71
“ “ “ “ “	26	29	27.5	29	28	29

The antlers in the three males, all with fully developed dentition, vary greatly in size and form, two of them being obviously young adults (see Figs. 15-16) and the other (No. 18951 of the above table, shown in Figs. 13-14) a fully mature male with finely developed antlers. The antlers of the two young adults are about as described by Mr. Thomas; those of the old adult are not symmetrical, the right antler being much smaller and with fewer points than the left. The right may be described as a tapering spike, slightly curved outward, 185 mm. long, with a single point on the anterior face, near the tip, about 20 mm. long. The right antler is branched, with a sharp upward curve beginning at the middle; the main beam, following the outside curvature, has a length of 215 mm., with a sharp-pointed sub-base tine, 30 mm. long, branching off from the anterointernal face 50 mm. above the bur, and two other points from the posterior border of the apical third



Fig. 15. *Odocoileus rothschildi*. No. 18149, ♂, young ad., Coiba Island, Panama.  $\frac{1}{2}$  nat. size.

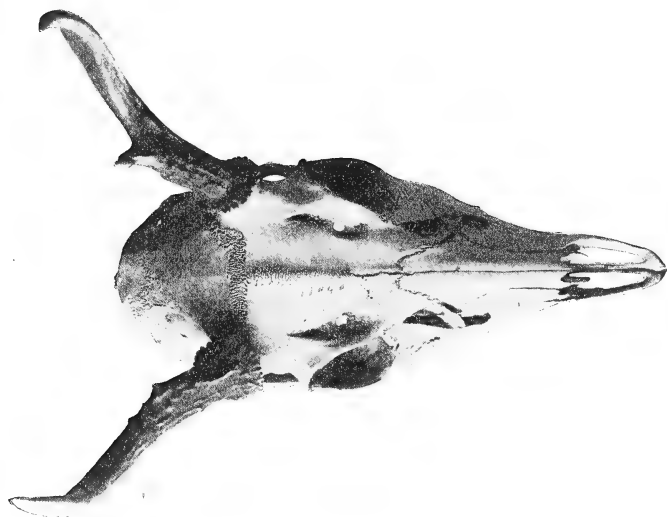


Fig. 16. *Odocoileus rothschildi*. Same skull as Fig. 15.  $\frac{1}{3}$  nat. size.

of the main beam, the anterior one about 50 mm. long, and the more apical one about 20 mm. long.

*O. rothschildi* is much darker colored when adult than *O. costaricensis*, and the young are less conspicuously spotted with white; it is also much smaller, as stated by Mr. Thomas, than either *O. costaricensis*, *truei*, or *thomasi*, as shown by a comparison of the skull measurements given above with those of the latter as published by Miller (Proc. Biol. Soc. Wash., XIV, 1901, pp. 36, 37). Two Chiriqui skulls of females of *O. costaricensis*, slightly younger (the last molar not functional) than the two from Coiba Island of which measurements are given above, considerably exceed the latter in size, being about 5-7 mm. broader and 15-20 mm. longer, with proportional increase in bulk, less frontal convexity, and larger antorbital vacuities.

II. ***Odocoileus costaricensis* Miller.** Three skins and skulls (2 adult females and one young in spotted coat), and 9 additional pairs of antlers, Boqueron, Oct. 9 and Dec. 4 and 15.

As said above, *O. costaricensis* is larger and paler, and the young are less conspicuously spotted, than *O. rothschildi*.

The nine pairs of antlers vary greatly in size and massiveness, but with two exceptions are very symmetrical in form. In color they are dark reddish brown, except one pair which is much lighter and was probably taken soon after the shedding of the velvet.

This series is instructive as showing the variation of the antlers in size and form with age, and also the individual variation. Although the antlers vary so greatly in development there is very little variation in the diameter of the brain cavity, which ranges in transverse width from 53 to 56 mm., the youngest specimens having slightly the greatest width of brain cavity. With the advance of age the walls of the skull thicken, so that the breadth of the skull at the postorbital constriction (between orbits and base of horn pedicles) increases from 78 mm. in the two youngest skulls to 88 in the normal adult, and to 99 in the exceptionally heavy pair (No. 21566, Fig. 17 g and g').



Fig. 17. *Odocoileus costaricensis*. Series of antlers illustrating variation with age. *a-g*, front view; *a'-g'*, same, side view. About  $\frac{1}{10}$  nat. size.

In the youngest pair (No. 21572) the main beam has a length<sup>1</sup> of only 117 mm., is curved inward at the tip, and carries a single point, 27 mm. long, the top of the fork being 44 mm. above the edge of the bur; circumference at base (just above bur), 65. (Fig. 17, *a* and *a'*.)

The next in size (No. 21573) has three points instead of two, the main beam in both antlers being forked at the tip. Length of main beam, 182; of basal tine, 47; of upper tine, 55; circumference at base, 83. (Fig. 17, *b* and *b'*.)

The third pair (No. 21567) is much longer, with a long, slender main beam and only the basal tine. Length of main beam, 280; basal tine, 60; circumference at base, 80. (Fig. 17, *c* and *c'*.)

The fourth pair (No. 21568) is less massive and shorter, but is more forked, the right antler having three points and the left antler four. Length of main beam, 237; circumference at base, 93. (Fig. 17, *d* and *d'*.)

The fifth pair (No. 21569) is thick and heavy but symmetrical, each antler having three points. Length of main beam, 260; circumference at base (just above bur), 112. (Fig. 17, *e* and *e'*.)

The sixth pair (No. 21570, apparently prematurely stripped of the



Fig. 18. *Odocoileus costaricensis*. Malformed antlers.  $\frac{1}{10}$  nat. size.

velvet) has the antlers long and slender, each with four points, but the upper one much less developed on the right than on the left. Length of main beam, 315; circumference at base, 100. (Fig. 17, *f* and *f'*.)

The seventh pair (No. 21566) is extraordinarily massive and otherwise evidently somewhat abnormal. Each antler has five points, but

<sup>1</sup> Measurement taken along outside curvature, in all cases. If the two antlers of a pair vary in size, the larger antler is the one measured.

the fifth on the right antler comes off at the inner base of the basal tine, and in the left is produced by the slight forking of the main branch of the antler, which is not, however, homologically the main beam. (Fig. 17, *g* and *g'*.) Length of main beam, 336; circumference at base, 120 (right antler) and 150 (left antler). In the left antler the basal prong is situated close to the bur, in the left at the usual point (about one third the length of the main beam above the bur). The animal that carried these antlers was doubtless very old, as well as very large, the portion of the cranium attached to the antlers being very heavily ossified, giving great breadth to the frontal processes supporting the antlers, while the diameter of the brain cavity is slightly less than in the youngest specimens of the series.

The eighth pair (No. 21571) is curiously malformed, as shown by the photograph reproduced in figure 18. The left antler, the longer of the pair, has a length of only 150 mm., and is abnormally developed throughout, the part that may be homologized as the basal tine starting from the bur, and being one half as long and nearly as massive as the main beam. The left frontal bone at the base of the antler shows exostosis and other unnatural conditions. The chief interest of the specimen is pathological, although it strongly recalls the specimen figured long ago by Pennant, which later became the basis of *Cervus mexicanus* of some of the earlier systematists.

12. ***Sciurus (Echinosciurus) melania* (Gray).** Ten specimens, Boqueron, Sept. 4–Dec. 29; selected from a large series, to show seasonal variation in color and pelage, already well described by Mr. Bangs (*l. c.*, p. 22). His specimens were from Divala, Bogaba, and Boquete, — from sea level to 2000 feet altitude.

13. ***Sciurus (Echinosciurus) adolpheii dorsalis* (Gray).** A single specimen from Remedios (collected by D'Arce), of the '*rigidus*' type.

14. ***Sciurus (Guerlinguetus) hoffmanni* (Peters).**

*Sciurus (Guerlinguetus) æstuans chiriquensis* BANGS, Bull. Mus. Comp. Zool., XXXIX, No. 2, April, 1902, 22.

Fourteen specimens: Boquete, 7, Aug. 22–Sept. 8; Boqueron, 7, Oct. 9–Nov. 25. Selected from a large series, to show seasonal and individual variation.

It appears to me that the Chiriqui animal is indistinguishable from Costa Rica specimens of true *S. hoffmanni*. The



palest specimens of the former (*chiriquensis* Bangs) are not paler than the palest of the *hoffmanni* series, and the brightest have the upper parts as red, and the tail fringe and ventral surface as deeply reddish orange, as any examples from Costa Rica. (On individual variation in this species see *antea*, p. 44.)

I also refer to *S. hoffmanni* a series of 12 specimens from the upper Cauca Valley, Colombia, showing that the form has an extended range to the southward of Costa Rica.

As stated by me five years since (this Bulletin, XII, p. 17, March 17, 1899), "true *æstuans* and *hoffmanni* should be recognized as distinct species," an opinion that seems to be shared by Mr. Bangs (*l. c.*, p. 23).

15. **Mus rattus** Linn. Seven specimens, Boqueron, Oct. 4, 23, and 29, and Nov. 23-30. Very abundant, with the habits of a wild species, being found remote from towns or the dwellings of man.

16. **Megadontomys flavidus** Bangs. Five specimens, Boquete (hence topotypes of the species), August 19-27.

17. **Peromyscus nudipes** (Allen).

*Hesperomys* (*Vesperimus*?) *nudipes* ALLEN, Bull. Am. Mus. Nat. Hist., III, No. 2, 1891, p. 213. La Carpintera, Costa Rica.

*Peromyscus cacabatus* BANGS, Bull. Mus. Comp. Zool., XXXIX, No. 2, p. 29, April, 1902.

Ten specimens, Boquete, Chiriqui, Aug. 21-25, mostly young adults.

*Peromyscus nudipes* was described in 1891 from a single specimen, preserved in alcohol, collected by Mr. George K. Cherrie at La Carpintera, Costa Rica. Later other specimens (skins in poor condition) were received from Messrs. Cherrie and Alfaro, collected at Jimenez, Isla Nueva (Irazu Range), Santa Clara, and near San José. Recently the Museum has received a series of 19 excellent specimens, collected mostly at the Rancho de R. Jimenez, Volcan de Irazu, by M. A. Carriker, Jr., in March and April, 1902. This series is apparently indistinguishable in coloration from Mr. Batty's

specimens collected at Boquete, and hence topotypes of Mr. Bangs's *Peromyscus cacabatus*, or from the type and 4 topotypes kindly sent me for comparison by Mr. Bangs. Nine adult skulls from Irazu and vicinity (practically topotypes of *P. nudipes*) do not differ appreciably in measurements or otherwise from the 5 adult skulls of *P. cacabatus* received from Mr. Bangs, the average difference in occipito-nasal length being only .4 of a millimeter. The external measurements of 10 adults from the Irazu series compared with measurements of a similar series from Boquete, recently published by Mr. Bangs (Bull. Mus. Comp. Zool., XXXIX, 1902, p. 30), shows that the total length is practically the same in the two series (varying only about 1 mm.), but the Irazu specimens show a greater tail length (by about 8 mm.), and a larger hind foot (by about 2 mm.) than the Boquete specimens. This apparent difference is doubtless due to different methods of measuring, especially as respects the relative length of the tail.

18. *Tylomys watsoni* Thomas. One specimen, adult male, Boqueron, Oct. 31.

19. *Sigmodon borucæ chiriquensis*, subsp. nov.

Type, No. 18789, ♂ ad., Boqueron, Chiriqui, Oct. 28; J. H. Batty.

Similar to *S. borucæ*, but darker and more heavily colored, the upper parts being deep yellowish brown, varied with black instead of light yellowish brown, and the underparts strongly buffy instead of white; nose and sides of upper lip broadly ochraceous buff instead of pale buff; bullæ more pyriform and postpalatal opening much broader.

Type, total length, 280; head and body, 175; tail vertebræ, 105; hind foot (in dry skin), 32; ear, 20. An adult female is a little smaller, but has a longer tail (tail vertebræ, 115).

Represented by 6 specimens, all from Boqueron, collected Oct. 12-27.

*S. b. chiriquensis* closely resembles in coloration *S. toltecus saturatus* Bailey from Chiapas and Vera Cruz, Mexico, but differs from it in cranial characters. It differs from *S. borucæ* in color and cranial characters, as noted above, *borucæ* being paler with a tendency to a grayish cast on the head and anterior half of the body in slight contrast with the posterior half, while in *chiriquensis* the coloration of the upper parts is

equally intense throughout. Costa Rica specimens of *boruca* present quite a range of variation in depth of coloration, and some of the darker specimens quite closely approach *chiriquensis*, but the well-marked differences in the form of the bullæ and the width of the postpalatal opening seem constant.

## 20. *Oryzomys costaricensis* Allen.

*Oryzomys vegetus* BANGS, Bull. Mus. Comp. Zool., XXXIX, No. 2, April, 1902, 35.

Seven specimens, Boquete (topotypes of *O. vegetus*), Aug. 19-29.

The type and 12 topotypes of *O. vegetus*, kindly sent me for examination by Mr. Bangs, do not differ appreciably from the type, 3 topotypes, and additional Costa Rica specimens of *O. costaricensis*. They also agree with the 7 Boquete specimens collected by Mr. Batty, which I unhesitatingly refer to *O. costaricensis*.

Mr. Bangs's *O. costaricensis* (*l. c.*), of which he has kindly sent me his series of 5 specimens, seems to represent merely a pale phase of *O. costaricensis*, due to individual variation. They are paler rufous above and nearly white below, but similar specimens occur in my series of 15 specimens from Costa Rica. The type of *O. vegetus* is, with one exception, the highest colored specimen of Mr. Bangs's series, but it is not very appreciably brighter than the type of *O. costaricensis*. Mr. Bangs informs me that he inadvertently placed the name *vegetus* on the dark form (= *costaricensis* vera) instead of on the light form, after having returned the specimens of *O. costaricensis* borrowed from this Museum, so that *vegetus* = *costaricensis* and the light form was left unnamed. As said above, it does not appear to be separable from true *costaricensis*; it is represented by 5 pale specimens selected from his series (= 13 'vegetus' + 5 'costaricensis'), all taken at the same locality, and some of each on the same dates.

21. *Zygodontomys cherriei* Allen. Eleven specimens, Boqueron, Oct. 12 and 25-31, and Nov. 20 and 25.

22. *Zygodontomys* (?), sp. One specimen, skin without skull, Boqueron, Oct. 28. Without the skull it is impossible to determine whether this specimen should be referred to *Sigmodon* or to *Zygodontomys*. In either case the species is apparently undescribed.

23. *Reithrodontomys costaricensis* Allen. Six specimens, Boquete, Aug. 20-29.

24. *Macrogeomys cavator* Bangs. Two specimens (topotypes), adult male and female, Boquete, altitude 5000 feet.

25. *Heteromys repens* Bangs. Two specimens, — adult female, Boqueron, Oct. 31; young in slaty pelage, Boquete, without date.

26. *Proechimys centralis chiriquinus* Thomas. Twelve specimens, selected from a large series, Boqueron, Oct. 21-Dec. 1.

27. *Coendou lænatus* Thomas. Four specimens, Boqueron, Oct. 25, Nov. 27, and Dec. 4.

28. *Dasyprocta coibæ* Thomas. Four specimens (topotypes), skins and skulls, and 2 additional skulls, Coiba Island, May 14-19 and June 19.

Mr. Batty has kindly given me his measurements, taken in the flesh, of 9 specimens, 3 males and 6 females; some of the latter are obviously not fully grown. The males measure respectively: Total length, 495, 555, 465; head and body, 465, 520, 435; tail, 30, 35, 30; hind foot, 120, 120, 115; ear, 40, 40, 35. The largest 3 females: Total length, 505, 510, 530<sup>1</sup>; head and body, 465, 470, 500; tail, 40, 40, 30; hind foot, 110, 117, 115; ear, 40, 40, 40.

29. *Lepus (Tapeti) gabbi* (Allen). Six specimens, including 4 adults and 2 very young examples, Boqueron, October and December, except one, taken in April, and without definite locality.

30. *Felis bangsi costaricensis* Merriam. One skin, without

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<sup>1</sup> The last of these three females is the type of the species. Collector's No. 129. Mr. Thomas's measurements were taken from the skin and naturally differ from the above.

skull, an adult female, Boqueron, Jan. 6. This specimen agrees well with Dr. Merriam's description of the type, from Boquete. The sides are bright reddish fulvous; the median dorsal region is much darker — or dark reddish chestnut — as is also the dorsal area of the tail; the tail darkens apically, so that the apical half is decidedly blackish, the tip being wholly black for the terminal two inches. The inguinal region is pure white, a small pectoral area whitish, and the intervening region is like the flanks but much paler. Fur between toe pads black; ears almost wholly black, the usual lighter areas being brownish black and the rest deep black.

31. ***Felis mearnsi***, nom. nov.

*Felis costaricensis* MEARNS, Proc. U. S. Nat. Mus., XXV, 245, Sept. 17, 1902. Talamanca, Costa Rica. Not *Felis bangsi costaricensis* Merriam, Dec. 11, 1901.

One specimen, young male, skin and skull, Boqueron, Aug. 28.

32. ***Felis panamensis***, sp. nov.

Type, No. 14946, ♀ (young adult), Boqueron, Chiriqui, Panama, Oct. 30; J. H. Batty.

General color above dusky gray, the dorsal region posteriorly, tail, inner surface of limbs and feet strongly blackish; sides and front of limbs lighter, the hairs broadly tipped with whitish, giving a dark gray effect; whole head, including ears, nape, and sides of neck, much lighter than body, rusty brownish gray varied minutely with black; top of shoulders and posterior third of the median dorsal region deep black, sparsely and irregularly varied with whitish tipped hairs; tail black above, sides and undersurface lighter, strongly varied with whitish gray hairs and gray-brown underfur; general color of ventral surface dark gray, strongly blackish on the chest; fore neck and throat rusty brown, varied slightly with dusky.

*Measurements.* — Total length, 985; head and body, 595; tail vertebrae, 390; hind foot (in dry skin), 128; ear, 40. Skull, total length, 96; basal length of Hensel, 80; zygomatic breadth, 62; least interorbital breadth, 15.5; least postorbital breadth, 32; width of braincase, 46; length of nasals, 24; width of nasals at front border, 12; do. at end of frontals, 5.3; length of palate, 33; audital bulla, 18 x 12; breadth at posterior end of carnassials, 37; upper tooththrow from front of canine, 30; length of upper carnassials, 12.5; length of lower carnassial, 9.7; length of lower jaw (front base of incisors to end of angular process), 60; height at condyle, 13; do. at coronoid, 27.

The dorsal contour of the skull is slightly and evenly convex, except that the nasals and occipital region slope abruptly downward. There is a strongly depressed sinus at the base of the nasals, as in *F. yagouaroundi*. The chief peculiarity of the dentition, aside from the small size of the teeth, is the reduction of the protocone of the upper carnassials, it being barely indicated by a slight bulging of the cingulum. In the *F. yagouaroundi* and *F. eyra* groups the protocone is strongly developed. The present skull is that of a middle-aged female, so that the general dimensions are less than would be the case in a very old skull with a highly developed occipital crest.

*Felis panamensis* is a member of the *yagouaroundi* group, distinguished especially by very dark coloration, the convex instead of the flat frontal region of the skull, and the practical absence of the protocone on the upper carnassial.

33. *Conepatus (Marputius) marpurito* (*Gmelin*). One specimen, male, Boqueron, Oct. 1901.

34. *Putorius (Arctogale) affinis* (*Gray*). One specimen, adult male, Boquete, altitude 5000 feet. On the right side of the head are a few white hairs, scattered singly over the whole side of the head from eye to ear; on the left is a very small oblong white spot just behind the eye, and another somewhat larger white spot in front of the lower base of the ear.

35. *Potos flavus chiriquensis*, subsp. nov.

Mr. Oldfield Thomas in his recent revision (*Ann. and Mag. Nat. Hist.*, (7) Vol. IX, April, 1902, pp. 266-270) of the Kinkajous (*Potos flavus* group, formerly *Cercoleptes caudivolvulus*), has recognized five subspecies, adopting for one of them Martin's name *megalotus*. It is to be regretted that he did not rule out both of Martin's names, as he did one of them, as unidentifiable. Martin (*P. Z. S.*, 1836, pp. 81-83) had two menagerie specimens, from unknown localities, which differed so much from each other that he thought they might "ultimately prove to be distinct species," and proceeded to describe them, naming them respectively *Cercoleptes megalotus* and *Cercoleptes brachyotus*. "In distinguishing between the two species of Kinkajous," he considered "it best to drop entirely

the specific title *caudivolvulus*, . . . the only mode in fact by which to avoid all possibility of confusion [!].”

Thomas says of these names (*l. c.*): “It is difficult to know how to deal with Martin’s *Cercoleptes megalotus* and *brachyotus*, described from menagerie specimens without localities, . . . the characters used being mainly due, according to Gray, to the ‘artifice of the preserver.’ . . . In any event the name [*brachyotus*] may be put aside for the present as indeterminable.” The other he adopts for a deep-colored form from “Costa Rica and Colombia,” mentioning an example from Medellin, Colombia, as agreeing “best with the description,” and cites others from Costa Rica, and from Valdivia and Santa Marta, Colombia, which “cannot be distinguished from it.” The five subspecies he recognized may be tabulated as follows:

*Potos flavus flavus*. Guiana.

*Potos flavus megalotus*. Costa Rica and Colombia.

*Potos flavus aztecus*. Mexico and Guatemala.

*Potos flavus modestus*. Guayas Province, Western Ecuador.

*Potos flavus meridensis*. Sierra Nevada, Merida, Venezuela.

Nothing is said about the range of *flavus* (typica) further than to consider “Surinam” as the type locality.

This Museum contains a series of 23 specimens of Kinkajous, of which 1 (without skull) is from Merida, Venezuela (topotype of *P. f. meridensis*); 7 from Santa Marta, Colombia; 4 from Castilla Mountains, Colombia (upper Cauca region); 4 from Chiriqui, Panama; 1 from Chapada, Matto Grosso, Brazil; and 6 menagerie specimens, without localities, and hence practically worthless. Mr. Bangs has kindly loaned me 6 others — 3 from Orizaba, Mexico, and 3 from Chiriqui.

The material from these six localities — Orizaba, Chiriqui, Merida, the Castilla Mountains, Santa Marta, and Chapada — represent six well-marked forms, three of which appear to be unnamed. The Merida specimen is, of course, Thomas’s *Potos flavus meridensis*. The Chiriqui specimens are very different from the Santa Marta specimens and must be separated from them; and in this connection comes up the difficult question of deciding on names for them, a matter which has

become complicated through Mr. Thomas's use of Martin's practically baseless name *megalotus* for "Costa Rica and Colombia" specimens collectively. I should discard *megalotus* as unidentifiable were it not that Thomas has habilitated it, and so under the 'first reviser' principle it may be conserved for a portion of the Costa Rica-Colombia combination. As most of his specimens were from Colombia, a Medellin example being particularly mentioned as agreeing "best with the description," and Valdivia and Santa Marta (Colombia) specimens "cannot be distinguished from it," it seems best to assign the name *megalotus* to the form of eastern Colombia; especially as my Santa Marta specimens agree far better with the description of *megalotus* than do those from Chiriqui.

The additional three forms may be recognized as follows:

***Potos flavus chiriquensis*, subsp. nov.**

Type, No. 18926, ♂ ad., Boqueron, Chiriqui, Panama, Oct. 22, 1901; J. H. Batty.

General color (type) above brownish yellow, the hairs individually being dull brownish yellow, tipped conspicuously and quite uniformly with blackish; middle of the back rather more blackish than the sides, but without a dark dorsal line; below dull greenish yellow (without black tips to the hairs), with a darker rusty brown streak along the middle of the abdomen; sides of neck, from shoulders to cheeks, and front of neck, yellowish rufous or golden rufous; ears colored like the surrounding pelage; tail above like the back for about four fifths of its length, becoming gradually darker or brownish black apically on the terminal fifth, the sides and below dull brownish yellow.

Six other specimens differ scarcely appreciably from the type; in two there is a slight tendency to a dark dorsal line.

*Measurements.* — The collector's measurements are as follows:

No.	Sex.	Total length.	Head and body.	Tail vertebræ.	Hind foot.	Ear.
18926	♂ type	990	485	505	80	42
10122 <sup>1</sup>	♂	960	460	500	93	40
18925	♂	815	390	425	75	36
18924	♀	975	480	495	75	40
18923	♀ juv.	747	350	397	80	40

Two adult skulls, No. 18926, male (type), and No. 18924, female, measure as follows: Occipito-nasal length, ♂ 92, ♀ 90; basal length (inner base of incisors to posterior border of condyles), ♂ 83, ♀ 82;

<sup>1</sup> Bangs Collection.



zygomatic breadth, ♂ 59, ♀ 58.6; interorbital breadth, ♂ 21.3, ♀ 20; width of braincase, ♂ 41, ♀ 40; length of palate (incisors to end of point), ♂ 31.5, ♀ 32.5; upper premolar-molar series, ♂ 20, ♀ 20; lower premolar-molar series, ♂ 23, ♀ 22; length of lower jaw (front base of incisors to posterior border of condyle), ♂ 61, ♀ 60.5; height at condyle, ♂ 30, ♀ 29; height at coronoid process, ♂ 43.5, ♀ 44.

The dental armature is heavy; the palate is flat (not, or only slightly, depressed at posterior border); bullæ small and flat.

Compared with Santa Marta (Colombia) specimens of *P. f. megalotus*, the general coloration is much deeper and darker throughout, the yellow of a more greenish cast, especially below, the tips of the hairs of the dorsal surface black instead of reddish brown, and the narrow dark dorsal stripe, usually well-marked in the Santa Marta specimens, is absent. As regards cranial characters, the skull is considerably larger (about 4 to 6 mm. longer and proportionately wider), and the teeth are fully one third broader and larger; the most marked difference, however, is seen in the form of the posterior part of the palatal floor, which is flat in *chiriquensis* and deeply and abruptly depressed in *megalotus*, thus greatly reducing the height of the posterior narial opening and giving to it an entirely different contour; the pterygoids, on the other hand, are much deeper or broader in *megalotus*, and the pterygoid hamuli much longer and slenderer; the posterior nares are much broader and shallower, and the audital bullæ are much more inflated.

*Potos f. chiriquensis* differs greatly in cranial characters from all the South American forms of the genus known to me, but finds a near ally in *P. f. aztecus*.

#### ***Potos flavus caucensis*, subsp. nov.**

Type, No. 14186, ♂ ad., Castilla Mountains (altitude 6000 feet), upper Cauca region, Colombia, June 9, 1898; J. H. Batty.

General coloration above yellowish brown, with a reddish tinge and washed with black, with a very prominent black median stripe extending from the shoulders posteriorly to the end of the tail; the hairs of the back are individually brownish gray for their basal two thirds, then broadly ringed with brownish rusty yellow and broadly tipped with black; top of head blackish, as are also the sides and top of nose, and a prominent stripe above and below the eye, forming a broad, nearly

complete, blackish eye-ring; ears externally blackish and quite large; ventral surface pale yellow, suffused with pale brownish rufous over the fore neck, darkening to a rusty pale chestnut median band on the chest, and on the abdomen to dark chestnut; limbs externally like the sides of the body, darkening slightly on the toes; tail above like the back, that is reddish brown with a darker median band, which expands apically to occupy the whole upper surface; lower surface of tail dull brownish yellow.

The four specimens agree in their generally very dark (blackish) coloration above, but vary a little in the amount of reddish brown suffusing the surface of the dorsal pelage.

*Measurements.* — Type, ♂ ad., total length, 874; head and body, 430; tail vertebræ, 444; hind foot (without claws), 79; ear, 36. Another specimen, ♀ ad.: Total length, 843; head and body, 413; tail vertebræ, 430; hind foot, 73; ear, 35. The skulls of these specimens measure, respectively: Occipito-nasal length, ♂ 89, ♀ 86; basal length, ♂ 83.5, ♀ 78; zygomatic breadth, ♂ 60, ♀ 57.5; interorbital breadth, ♂ 17, ♀ 18; width of braincase, ♂ 40, ♀ 41; length of palate, ♂ 36, ♀ 36; upper premolar-molar series, ♂ 20, ♀ 20; lower premolar-molar series, ♂ 23, ♀ 22; length of lower jaw, ♂ 61, ♀ 58; height at condyle, ♂ 29.5, ♀ 27.5; height at coronoid, ♂ 41, ♀ 41.5. These specimens are both middle-aged adults.

This subspecies needs no comparison with *P. f. megalotus* (as represented by Santa Marta, Colombia, specimens), being so widely different in color; and it is equally distinct in coloration from *P. f. chiriquensis*, and radically distinct from it in cranial characters. It belongs to the group having the palatal floor posteriorly depressed, and with the teeth relatively small, and should be perhaps compared with *P. f. modestus*, from southwestern Ecuador, which it apparently approaches in coloration, but exceeds in size. It also has a general resemblance in coloration to *P. f. meridensis*, but the yellow of the lower parts is paler and much less suffused with orange, and it appears to be much larger.

***Potos flavus chapadensis*, subsp. nov.**

Type, No.  $\frac{1412}{858}$ , ♂? ad., Chapada, Matto Grosso, Brazil, August, 1885; Herbert H. Smith.

Above dull yellowish brown, the tips of the hairs blackish; an indistinct and somewhat interrupted dark dorsal stripe from behind the shoulders to the rump; top of head rather darker than back, through the greater abundance of blackish-tipped hairs; ears large,

externally blackish brown, much darker than the surrounding pelage; limbs dull yellowish brown, slightly darker on the toes; tail similar in color to the back, slightly darker above toward the base and terminally, dull yellow below; ventral surface of body centrally deep ochraceous orange, lighter, clearer yellow on the sides.

*Measurements.* — Total length, 1123; head and body, 572; tail vertebrae, 551; hind foot (in skin), 76; ear, 45. Skull, occipito-nasal length, 92; basal length, 82; zygomatic breadth, 59; interorbital, 21; width of braincase, 39; length of palate, 37.5; upper premolar-molar series, 19; lower premolar-molar series, 20; length of lower jaw, 62; height at condyle, 28; height at coronoid, 45.5.

The palate is thinned out posteriorly, but scarcely at all depressed; teeth very small; audital bullæ large and much inflated, very much larger and much more swollen than in any of the northern forms of the genus. The specimen is old, with well-developed sagittal and occipital crests; the sex is given as "♂?", and is probably male.

The cranial characters separate this subspecies quite sharply from the northern forms, and the coloration is rather peculiar in the deep orange ochraceous tint of nearly the whole ventral surface, and the absence of the strong dorsal streak seen especially in *P. f. meridensis*, *modestus*, and *caucensis*, and, according to Thomas, in *flavus*.

36. ***Nasua narica panamensis* Allen.** One specimen, adult female, Boqueron, Oct. 29. Total length, 1080; head and body, 540; tail, 540; hind foot, 85.

I am indebted to Mr. Bangs for the opportunity to examine, in this connection, his series of 6 specimens from Boquete. While they agree in color with *bullata*, they lack the excessive development of the audital bullæ seen in that form, as already noted (*antea*, p. 51).

37. ***Procyon lotor hernandezii* (Wagler).** One specimen, female, Boqueron.

38. ***Myotis nigricans* (Wied).** Two specimens, Boqueron.

39. ***Myotis chiriquensis*, sp. nov.**

Type, No. 18736, ♀ ad., Boqueron, Chiriqui, Panama, Oct. 16, 1901; J. H. Batty. Represented by three specimens, taken at the same locality and date.

Size very small, smallest of the known American species of *Myotis*; pelage thick, soft, and rather short.

Above very dark brown; pelage beneath the surface blackish, the hairs individually very slightly tipped with gray, blending with the ground color to give a general effect of very dark brown; below basal two thirds of pelage deep plumbeous, the apical third or fourth lighter or pale brown, the ventral surface being thus decidedly paler than the dorsal; ears and membranes dark brown or blackish. Wing from base of toes; uropatagium naked above, slightly hairy at extreme base below; ears medium, rather pointed, deeply incised on the outer border.

*Measurements.* — Type, from dry skin: Total length, 73; head and body, 43; tail vertebrae, 30; tibia, 11.5; foot, 6.5; forearm, 26; thumb, 4; 3d finger: metacarpal, 31; 1st phalanx, 11; 2d phal., 10; 3d phal., 6.5; ear from meatus, 10; tragus, 5. Another specimen gives the same measurements, and a third is slightly larger.

Skull, total length, 13.6; mastoid breadth, 6.5.

*Myotis chiriquensis* is similar in coloration to *M. nigricans*, and also in the shape of the skull, from which species it is easily distinguished by its much smaller size — forearm 26 against 34 in *nigricans* from the same locality. It seems to be, in fact, a miniature of *M. nigricans*.

40. *Vespertilio fuscus miradorensis* (H. Allen). Three specimens, Boquete, Sept. 8 and 15.

41. *Molossus obscurus Geoffroy*. Six specimens: Boqueron, 2, Oct. 15 and Nov. 20; Coiba Island, 4, June 1-3.

42. *Natalus stramineus Gray*. One specimen, Coiba Island, June 1.

43. *Vampyrus spectrum* (Linn.). Two specimens, adult male and female, Boqueron, Dec. 1. Expanse, 765, 740; ear, 40, 40.

44. *Phyllostomus hastatus* (Pallas). Six specimens, Boqueron, Oct. 6 and 15, and Dec. 4 and 8. The measurements, given for 3 specimens only, are: Expanse, 2 males, each 650, 1 female, 630; ear, 12-12.5.

45. *Hemiderma perspicillatum* (Linn.). Seventeen specimens, Boqueron, Sept. 30-Oct. 6 and Nov. 11.

46. *Glossophaga soricina* (Pallas). Thirteen specimens, Boqueron, Sept. 30, Oct. 3, Nov. 1-19, and Dec. 1 and 16.

47. *Artibeus intermedius* J. A. Allen. One specimen, Boqueron, Dec. 19.

48. *Artibeus watsoni* Thomas. Six specimens, Boqueron, Oct. 4, Nov. 1, 13, and 18.

49. *Vampyrops helleri* Peters. Six specimens, Boqueron, Oct. 2, 3, 26, and 28.

50. *Desmodus rotundus* (E. Geoffr.). One specimen, Boqueron, Dec. 5.

51. *Alouatta palliata* (Gray). Seven specimens, all adult: Boqueron, 1, adult male, Dec, 2; Boquete, 6 (3 males, 3 females), Aug. 20-23. Selected from a large series.

The collector's external measurements are as follows:

Total length.	Head and body.	Tail vertebræ.	Hind foot.	Ear.
♂, 1180	550	630	150	30
♂, 1020	520	500	140	25
♂, 1095	525	570	135	30
♂, 1160	570	590	140	35
♂, 1195	565	630	155	35
♀, 1090	530	560	135	25
♀, 1075	515	560	140	35

The skull varies greatly in size with age. The oldest male, with the teeth greatly worn and the temporal ridges united to form a low sagittal crest, has a basal length (inner base of incisors to posterior border of occipital condyles) of 103 mm. and a zygomatic breadth of 91, the same measurements in a young adult being 84 and 72. The 7 skulls measure as follows:

♂, Basal length, 103; zygomatic breadth, 91.				
♂,	"	"	101;	" 88
♂,	"	"	100;	" 86.5
♂,	"	"	99;	" 86
♂,	"	"	84;	" 72
♀,	"	"	85;	" 74
♀,	"	"	85;	" 73

The range of individual color variation is strikingly great. Two males, strictly comparable as to age (as shown by the skulls), and representing the extremes of a large series, differ as follows: One has the whole head, shoulders, lower back,

limbs, and tail deep black, with the median area of the back dull black, lighter than the head, shoulders, and limbs, and passing gradually into the lighter color of the flanks, many of the hairs at the sides of the median area being tipped with pale, glistening yellowish; flank stripe narrow, brownish yellow on the lower edge, brighter, glistening pale yellow along the middle; ventral surface dull ruddy brown, with a decidedly rufous tinge on the breast. The other also has the head, shoulders, rump, limbs, and tail deep black, but the middle region of the back is brownish black, more or less suffused with fulvous except along the median line; flank stripe, extending from front of shoulder posteriorly to thigh, deep golden rufous (in another specimen almost golden chestnut); ventral surface rusty brown.

52. *Saimiri œrstedii* (*Reinh.*). Six specimens, Boqueron, Oct. 4–Nov. 11. Three males and two females measure as follows: Total length, 687 (670–705); head and body, 295 (290–300); tail vertebræ, 392 (380–405); hind foot, 85 (76–90); ear, 25.5 (25–27).

53. *Cebus hypoleucus* (*Humboldt*). Six specimens: 5 adults, Boqueron, Oct. 9–Dec. 10; 1 young, Boquete, Sept. 20.

The collector's measurements of the adults are as follows:

Total length.	Head and body.	Tail vertebræ.	Hind foot.	Ear.
♂, 880	420	460	120	35
♂, 783	343	440	130	30
♀, 820	390	430	123	35
♀, 860	405	455	120	31
♀, 840	385	455	120	30

The males and females do not appear to differ in the relative elongation or color of the hair of the frontal region.

Article V.—TYPES OF LEPIDOPTERA IN THE COLLECTION OF THE AMERICAN MUSEUM OF NATURAL HISTORY.

By WILLIAM BEUTENMÜLLER.

Since the publication of the lists of the types of Lepidoptera in the Grote and Robinson and Henry Edwards collections which appeared in the Museum Bulletin, Volume IV, 1893, pages 59-64 and 167-198, respectively, the following types have been added to the Museum Collection. A few species are also added which were omitted from the previous lists. Part I consists of North American species, and Part II of African species.

PART I.

LYCÆNIDÆ.

*Thecla ilavia* *Beuten.*, Journ. N. Y. Ent. Soc., Vol. VII, 1899, p. 254.

Two males and two females. Texas.

*Thecla crysalis* var. *citima* *Hy. Edw.*, Papilio, Vol. I, 1881, p. 53.

One female. Summit of Cañon Mt., Utah.

*Lycæna ardea* *Edw.*, Trans. Am. Ent. Soc., Vol. III, 1871, p. 209.

One male. Nevada.

PIERIDÆ.

*Callidryas fisheri* *Hy. Edw.*, Papilio, Vol. III, 1883, p. 43.

One male. La Paz, Lower California.

SATYRIDÆ.

*Chionobas macounii* *Edw.*, Can. Ent., Vol. XVII, 1885, p. 71.

One male. Nepigon, Canada.

BOMBYCIDÆ.

*Triprocris lustrans* *Beuten.*, Bull. Am. Mus. Nat. Hist., Vol. VI, 1894, p. 367.

One male. Colorado.

*Olene montana* *Beuten.*, Bull. Am. Mus. Nat. Hist., Vol. XIX, 1903, p. 585.

Male and female, larva and cocoons. Black Mountains, North Carolina.

*Euhyparpax rosea* *Beuten.*, Bull. Am. Mus. Nat. Hist., Vol. V, 1893, p. 19.

One male. Colorado.

March, 1904.]

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## NOCTUIDÆ.

- Acronycta pacifica** *Smith*, Ent. News, Vol. VIII, 1897, p. 148.  
Two males (cotypes). California.
- Acronycta hesperida** *Smith*, Ent. News, Vol. VIII, 1897, p. 148.  
Three females (cotypes). Tacoma, Washington.
- Acronycta frigida** *Smith*, Ent. News, Vol. VIII, 1897, p. 148.  
Two females (cotypes). California.
- Mamestra altua** *Smith*, Trans. Am. Ent. Soc., Vol. XXVII, 1901, p. 236.  
Two males and two females (cotypes). Utah; Colorado.
- Mamestra davena** *Smith*, Trans. Am. Ent. Soc., Vol. XXVII, 1901, p. 237.  
Two males and four females (cotypes). Sierra Nevada, California, and Colorado.
- Mamestra megarena** *Smith*, Trans. Am. Ent. Soc., Vol. XXVII, 1901, p. 236.  
Male and female (cotypes). Glenwood Springs, Colorado.
- Mamestra lucina** *Smith*, Trans. Am. Ent. Soc., Vol. XXVII, 1901, p. 236.  
Two males and one female. Winnipeg, Canada.
- Leucania neptis** *Smith*, Proc. U. S. Nat. Mus., Vol. XXV, 1902, p. 188.  
Two males (cotypes). Ft. Collins, Colorado.
- Leucania rubipalleus** *Smith*, Proc. U. S. Nat. Mus., Vol. XXV, 1892, p. 182.  
One male and two females (cotypes). Utah, and Sierra Nevada, California.
- Leucania palliseca** *Smith*, Proc. U. S. Nat. Mus., Vol. XXV, 1902, p. 203.  
Two females (cotypes). California.
- Catocala frenchii** *Poling*, Can. Ent., Vol. XXXIII, 1901, p. 125.  
One male (cotype). British Columbia.
- Catocala faustina** var. *carlota* *Beuten.*, Bull. Am. Mus. Nat. Hist., Vol. IX, 1897, p. 212, fig. 1.  
One female. Sierra Nevada, California.
- Catocala relictæ** var. *clara* *Beuten.*, Bull. Am. Mus. Nat. Hist., Vol. XIX, 1903, p. 506.  
Several specimens. New York.
- Catocala aholibah** var. *coloradensis* *Beuten.*, Bull. Am. Mus. Nat. Hist. Vol. XIX, 1903, p. 507.  
One specimen. Glenwood Springs, Colorado.
- Catocala amica** var. *suffusa* *Beuten.*, Bull. Am. Mus. Nat. Hist., Vol. XIX, 1903, p. 508. One male. Texas.
- Catocala aspasia** var. *sierræ* *Beuten.*, Bull. Am. Mus. Nat. Hist., Vol. IX, 1897, p. 212.  
Three specimens. Sierra Nevada, California.



## SESIIDÆ.

- Melittia magnifica** *Beuten.*, Bull. Am. Mus. Nat. Hist., Vol. XII, 1899, p. 151.  
One female. Texas.
- Ægeria emphytiformis** *Walk.*, Cat. Lepid. Brit. Mus., Pt. VIII, 1856, p. 43 (= *Gaëa emphytiformis*).  
One female. (Locality not known.)
- Trochilium luggeri** *Hy. Edw.*, Psyche, Vol. VI, 1891, p. 108, pl. iii, fig. 3 (= *Memythrus simulans* Gr.).  
One female. Minnesota.
- Scipteron dollii** var. **castaneum** *Beuten.*, Bull. Am. Mus. Nat. Hist., Vol. IX, 1897, p. 213 (= *Memythrus dollii* var. *castaneus*).  
Male and female. Kentucky.
- Sanninoidea exitiosa** var. **edwardsii** *Beuten.*, Bull. Am. Mus. Nat. Hist., Vol. XII, 1899, p. 160.  
One female. New York.
- Sesia deceptiva** *Beuten.*, Bull. Am. Mus. Nat. Hist., Vol. VI, 1894, p. 93 (= *Sesia gilii* Hy. Edw.).  
Two males. Colorado.
- Sesia arizonæ** *Beuten.*, Journ. N. Y. Ent. Soc., Vol. VI, 1898, p. 240.  
One female. Arizona.
- Sesia culiciformis** var. **americana** *Beuten.*, Bull. Am. Mus. Nat. Hist., Vol. VIII, 1896, p. 136 (= *Sesia americana* *Beuten.*).  
One male and three females. Nevada.
- Sesia ithacæ** *Beuten.*, Bull. Am. Mus. Nat. Hist., Vol. IX, 1897, p. 215.  
Male and female. Ithaca, New York.
- Ægeria rubristigma** *Kellicott*, Can. Ent., Vol. XXIV, 1892, p. 211 (= *Sesia rubristigma*).  
One male. Ohio.
- Sesia sigmoidea** *Beuten.*, Bull. Am. Mus. Nat. Hist., Vol. IX, 1897, p. 214, 220.  
Male and female. New Hampshire; Massachusetts.
- Sesia palmii** *Beuten.*, Journ. N. Y. Ent. Soc., Vol. X, 1902, p. 126.  
One male. Arizona.
- Sesia tacoma** *Beuten.*, Journ. N. Y. Ent. Soc., Vol. VI, 1898, p. 240.  
Two males and four females. Mt. Ranier, Washington.
- Sesia seminole** *Beuten.*, Journ. N. Y. Ent. Soc., Vol. VII, 1899, p. 255.  
One male and two females. Lake Worth, Florida.
- Sesia marica** *Beuten.*, Journ. N. Y. Ent. Soc., Vol. VII, 1899, p. 254.  
One male. Punta Gorda, Florida.
- Sesia mariona** *Beuten.*, Mem. Am. Mus. Nat. Hist., Vol. I, Pt. VI, 1901, p. 308.  
One female. Colorado.
- Ægeria edwardsii** *Beuten.*, Bull. Am. Mus. Nat. Hist., Vol. VI, 1894, p. 92 (= *Sesia edwardsii*).  
One female. Colorado.

- Carmenta nigra** *Beuten.*, Bull. Am. Mus. Nat. Hist., Vol. VI, 1894, p. 95 (= *Sesia nigra*).  
One female. Utah.
- Pyrrhotænia coccinea** *Beuten.*, Journ. N. Y. Ent. Soc., Vol. VI, 1898, p. 241 (= *Calasesia coccinea*).  
One female. New Mexico.
- Larunda palmii** *Neum.*, Ent. News, Vol. II, 1891, p. 108 (= *Paranthrene palmii*).  
One male. Arizona.
- Zenodoxus mexicanus** *Beuten.*, Bull. Am. Mus. Nat. Hist., Vol. IX, 1897, p. 216 (= *Paranthrene mexicanus*).  
One female. New Mexico.

## PART II.

### BOMBYCIDÆ.

- Orgyia ticana** *Schaus*, Lepid. Sierra Leone, 1893, p. 27, pl. i, fig. 11.  
One male. Sierra Leone, Africa.
- Heterolepis plotzi** *Schaus*, Lepid. Sierra Leone, 1893, p. 27, pl. ii, fig. 1.  
One male. Sierra Leone, Africa.
- Redoa laba** *Schaus*, Lepid. Sierra Leone, 1893, p. 25, pl. i, fig. 4.  
Male and female. Sierra Leone, Africa.
- Stibolepis odites** *Schaus*, Lepid. Sierra Leone, 1893, p. 30, pl. i, fig. 9.  
One male. Sierra Leone, Africa.
- Anace burra** *Schaus*, Lepid. Sierra Leone, 1893, p. 23, pl. i, fig. 6.  
One male. Sierra Leone, Africa.
- Aletis flammea** *Schaus*, Lepid. Sierra Leone, 1893, p. 24, pl. ii, fig. 2.  
One female. Sierra Leone, Africa.
- Artaxa modesta** *Schaus*, Lepid. Sierra Leone, 1893, p. 26, pl. ii, fig. 4.  
One male. Sierra Leone, Africa.
- Gonometa matuta** *Schaus*, Lepid. Sierra Leone, 1893, p. 32, pl. ii, fig. 8.  
Male and female. Sierra Leone, Africa.
- Homochroa orphne** *Schaus*, Lepid. Sierra Leone, 1893, p. 31, pl. i, fig. 7.  
Male and female. Sierra Leone, Africa.
- Lasiocampa heres** *Schaus*, Lepid. Sierra Leone, 1893, p. 31, pl. i, fig. 8.  
Two males and one female. Sierra Leone, Africa.
- Lasiocampa mæra** *Schaus*, Lepid. Sierra Leone, 1893, p. 32, pl. ii, fig. 5.  
One male. Sierra Leone, Africa.
- Miresa syrtis** *Schaus*, Lepid. Sierra Leone, 1893, p. 28, pl. ii, fig. 3.  
One male. Sierra Leone, Africa.
- Taragama postalbida** *Schaus*, Bull. Am. Mus. Nat. Hist., Vol. IX, 1897, p. 325.  
Male and female. Sierra Leone, Africa.
- Trabaloides citrina** *Schaus*, Bull. Am. Mus. Nat. Hist., Vol. IX, 1897, p. 326.  
Male and female. Sierra Leone, Africa.

- Trisula magnifica** Schaus, Lepid. Sierra Leone, 1893, p. 38, pl. iii, fig. 8.  
One female. Sierra Leone, Africa.
- Utidava citana** Schaus, Lepid. Sierra Leone, 1893, p. 26, pl. i, fig. 10.  
One male. Sierra Leone, Africa.
- Syntomis divalis** Schaus, Lepid. Sierra Leone, 1893, p. 21, pl. i, fig. 2.  
One male. Sierra Leone, Africa.
- Lælia fracta** Schaus, Liped. Sierra Leone, 1893, p. 26, pl. i, fig. 12.  
One male. Sierra Leone, Africa.
- Lælia rosea** Schaus, Lepid. Sierra Leone, 1893, p. 26, pl. i, fig. 5.  
One male. Sierra Leone, Africa.
- Metanastris clementi** Schaus, Bull. Am. Mus. Nat. Hist., Vol. IX, 1897, p. 325.  
Male and female. Sierra Leone, Africa.

## NOCTUIDÆ.

- Birtha talusina** Schaus, Lepid. Sierra Leone, 1893, p. 37, pl. iii, fig. 12.  
One male. Sierra Leone, Africa.
- Ochropleura talda** Schaus, Lepid. Sierra Leone, 1893, p. 33, pl. iii, fig. 1.  
One female. Sierra Leone, Africa.
- Opigena accipiter** Schaus, Lepid. Sierra Leone, 1893, p. 33, pl. ii, fig. 7.  
One male. Sierra Leone, Africa.
- Perigea africana** Schaus, Lepid. Sierra Leone, 1893, p. 33, pl. ii, fig. 10.  
One female. Sierra Leone, Africa.
- Gonitis leonis** Schaus, Lepid. Sierra Leone, 1893, p. 36, pl. iii, fig. 10.  
One male. Sierra Leone, Africa.
- Leocyma pollusca** Schaus, Lepid. Sierra Leone, 1893, pl. ii, fig. 12.  
One female. Sierra Leone, Africa.
- Leocyma polla** Schaus, Lepid. Sierra Leone, 1893, pl. ii, fig. 11.  
One female. Sierra Leone, Africa.
- Leocyma fustina** Schaus, Lepid. Sierra Leone, 1893, pl. ii, fig. 9.  
One female. Sierra Leone, Africa.
- Meliana bertha** Schaus, Lepid. Sierra Leone, 1893, p. 34, pl. iii, fig. 3.  
One male. Sierra Leone, Africa.
- Calobachyla silona** Schaus, Lepid. Sierra Leone, 1893, p. 40, pl. iii, fig. 5.  
One female. Sierra Leone, Africa.
- Hydrillodes janalis** Schaus, Lepid. Sierra Leone, 1893, p. 41, pl. iii, fig. 11.  
One female. Sierra Leone, Africa.
- Hypena saltalis** Schaus, Lepid. Sierra Leone, 1893, p. 40, pl. iii, fig. 14.  
One female. Sierra Leone, Africa.
- Hypena ? ducalis** Schaus, Lepid. Sierra Leone, 1893, p. 40, pl. iii, fig. 13.  
One male. Sierra Leone, Africa.
- Focilla docta** Schaus, Lepid. Sierra Leone, 1893, p. 39, pl. iii, fig. 15.  
One male. Sierra Leone, Africa.
- Xanthoptera colla** Schaus, Lepid. Sierra Leone, 1893, p. 35, pl. iii, fig. 6.  
One female. Sierra Leone, Africa.

- Xanthoptera allecta** *Schaus*, Lepid. Sierra Leone, 1893, p. 36, pl. iii, fig. 4.  
One female. Sierra Leone, Africa.

## PYRALIDÆ.

- Coptobasis leonalis** *Schaus*, Lepid. Sierra Leone, 1893, p. 45, pl. iii, fig. 9.  
One female. Sierra Leone, Africa.
- Cirrochrista saltusalis** *Schaus*, Lepid. Sierra Leone, 1893, p. 45, pl. iii, fig. 9.  
One female. Sierra Leone, Africa.
- Dichrocrocis fuscoalbalis** *Hamp.*, Proc. Zoöl. Soc. London, 1898, p. 292.  
One male. Sierra Leone, Africa.
- Phryganodis erebusalis** *Hamp.*, Proc. Zoöl. Soc. London, 1898, p. 678.  
One male (cotype). Sierra Leone, Africa.
- Chalcidoptera bilunalis** *Hamp.*, Proc. Zoöl. Soc. London, 1898, p. 665.  
One male. Sierra Leone, Africa.
- Sylepta megastigmalis** *Hamp.*, Proc. Zoöl. Soc. London, 1898, p. 723.  
One male. Sierra Leone, Africa.
- Sylepta clementii** *Hamp.*, Proc. Zoöl. Soc. London, 1898, p. 716, pl. xlix, fig. 11.  
One female. Sierra Leone, Africa.

The following species, I am informed, will be described by Sir George F. Hampson in a forthcoming paper on Pyralidæ.

- Paraglossa zonalis** *Hamp.* (MS.).  
One male (cotype). Sierra Leone, Africa.
- Strigulina rhodoplagia** *Hamp.* (MS.).  
One male (cotype). Sierra Leone, Africa.
- Tegulifera chrysoproctalis** *Hamp.* (MS.).  
One male (cotype). Sierra Leone, Africa.
- Tegulifera vinotinctalis** *Hamp.* (MS.).  
One male (cotype). Sierra Leone, Africa.
- Tyndis pictimarginalis** *Hamp.* (MS.).  
One male (cotype). Fiji.
- Rhodo neura micragraphalis** *Hamp.* (MS.).  
One male (cotype). Sierra Leone, Africa.
- Rhodoneura latizonalis** *Hamp.* (MS.).  
One female. Sierra Leone, Africa.

**Article VI. — TYPES OF DIPTERA IN THE COLLECTION  
OF THE AMERICAN MUSEUM OF NATURAL  
HISTORY.**

By WILLIAM BEUTENMÜLLER.

The types mentioned in the present paper are mainly from the fine collection of Diptera which was generously donated to the Museum by Prof. William Morton Wheeler. A number were also kindly donated by Mr. Charles T. Brues. The species by Osten Sacken are some specimens from the material on which he based his paper on western Diptera, and are equivalent to cotypes. The galls mentioned in the supplement are specimens from the Osten Sacken collection, and may be classed as cotypes.

**CECIDOMYIDÆ.**

**Cecidomyia antennariæ** *Wheeler*, Proc. Wisc. Nat. Hist. Soc., 1889,  
p. 209.

One female and gall.

**Asynapta antennariæ** *Wheeler*, Proc. Wisc. Nat. Hist. Soc., 1889, p. 212.  
Two females, two males, and one gall.

**TIPULIDÆ.**

**Tipula beatula** *O. S.*, Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden),  
Vol. III, 1877, p. 209.  
Two specimens.

**Pedicia obtusa** *O. S.*, Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden),  
Vol. III, 1877, p. 205.  
One specimen.

**STRATIOMYIDÆ.**

**Clitellaria rustica** *O. S.*, Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden), Vol. III, 1877, p. 213.  
One specimen.

**TABANIDÆ.**

**Tabanus insuetus** *O. S.*, Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden), Vol. III, 1877, p. 219.  
One specimen.

**Pangonia hera** *O. S.*, Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden), Vol. III, 1877, p. 214.  
Two specimens.

## ASILIDÆ.

**Cyrtopogon cymbalista** O. S., Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden), Vol. III, 1877, p. 297.

Two specimens.

**Laphria astur** O. S., Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden), Vol. III, 1877, p. 285.

Two specimens.

## SYRPHIDÆ.

**Syrphus protritrus** O. S., Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden), Vol. III, 1877, p. 328.

One specimen.

**Sphærophoria micrura** O. S., Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden), Vol. III, 1877, p. 330.

One specimen.

**Eupeodes volucris** O. S., Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden), Vol. III, 1877, p. 329.

One specimen.

## TABANIDÆ.

**Tabanus ægrotus** O. S., Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden), Vol. III, 1877, p. 219.

Two specimens.

**Tabanus sonomensis** O. S., Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden), Vol. III, 1877, p. 219.

Three specimens.

**Chrysops proclivis** O. S., Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden), Vol. III, 1877, p. 222.

Four specimens.

## BOMBYLIIDÆ.

**Anthrax edwardsii** Coq., Journ. N. Y. Ent. Soc., Vol. II, 1894, p. 102.

**Exoprosopa doris** O. S., Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden), Vol. III, 1877, p. 225.

One specimen.

**Exoprosopa dorcadion** O. S., Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden), Vol. III, 1877, p. 231.

Three specimens.

**Exoprosopa eremita** O. S., Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden), Vol. III, 1877, p. 236.

One specimen.

**Anthrax alpha** O. S., Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden), Vol. III, 1877, p. 239.

One specimen.

**Anthrax serpentina** O. S., Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden), Vol. III, 1877, p. 237 (*Dipalta*).

Three specimens.

**Bombylius lancifer** O. S., Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden), Vol. III, 1877, p. 251.

Three specimens.

**Ploas fenestrata** O. S., Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden), Vol. III, 1877, p. 261.

One specimen.

**Epibates marginatus** O. S., Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden), Vol. III, 1877, p. 272.

Three specimens.

#### ACROCERIDÆ.

**Pterodontia misella** O. S., Bull. U. S. Geol. and Geogr. Surv. Terr. (Hayden), Vol. III, 1877, p. 277.

Two specimens.

**Opsebius agelinæ** Mel., Ent. News, Vol. XIII, 1903, p. 180. (= *Opsebius pterodontinus* O. S.).

#### EMPIDIDÆ.

**Phoneutisca simplicior** Wheeler and Mel., Biol. Cent.-Am., 1901, Dipt. Suppl., p. 375.

One specimen.

**Stilpon houghii** Mel., Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 206.

Two specimens.

**Stilpon pectiniger** Mel., Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 205.

One male.

**Elaphropeza montana** Mel., Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 213.

Four specimens.

**Drapetis nitida** Mel., Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 207.

Five specimens.

**Drapetis medetera** Mel., Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 208.

Five specimens.

**Drapetis dividua** Mel., Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 208.

Four specimens.

**Drapetis latipennis** Mel., Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 209.

Four specimens.

**Drapetis femoralis** Wheeler and Mel., Biol. Cent.-Am., 1901, Dipt. Suppl., p. 375.

One specimen.

**Drapetis septentrionalis** Mel., Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 211.

One specimen.

- Drapetis spectabilis* *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902,  
p. 212.  
Four specimens.
- Platypalpus caligatus* *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902,  
p. 216.  
Two specimens.
- Platypalpus monticola* *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII,  
1902, p. 217.  
Three specimens.
- Platypalpus pluto* *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p.  
217.  
Five specimens.
- Platypalpus impexus* *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902,  
p. 219.  
One specimen.
- Platypalpus canus* *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902,  
p. 220.  
Five specimens.
- Platypalpus hians* *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 220.  
Three specimens.
- Platypalpus inops* *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p.  
220.  
Four specimens.
- Platypalpus incurvus* *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902,  
p. 221.  
Five specimens.
- Platypalpus gravidus* *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902,  
p. 221.  
Five specimens.
- Platypalpus hastatus* *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902,  
p. 222.
- Platypalpus tenellus* *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902,  
p. 223.  
Three specimens.
- Tachydromia enecator* *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902,  
p. 226.  
One specimen.
- Tachydromia inusta* *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902,  
p. 226.  
Five specimens.
- Coloboneura inusitata* *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902,  
p. 230.  
One specimen.
- Litanomyia elongata* *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902,  
p. 232.  
Two specimens.



- Hemerodromia mexicana** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 235.  
One specimen.
- Hemerodromia collusor** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 235.  
Four specimens.
- Lactistomyia insolita** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 251.  
One specimen.
- Oreothalia pelops** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 233.  
Four specimens.
- Clinocera dolicheretma** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 241.  
Four specimens.
- Clinocera lecta** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 243.  
One specimen.
- Clinocera taos** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 242.  
One specimen.
- Clinocera lepida** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 241.  
One specimen.
- Meghyperus nitidus** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 255.  
Two specimens.
- Syneches quadrangularis** *Wheeler and Mel.*, Biol. Cent.-Am., 1901, Dipt. Suppl., p. 374.  
One specimen.
- Hybos mellipes** *Wheeler and Mel.*, Biol. Cent.-Am., 1901, Dipt. Suppl.  
Two specimens.
- Hybos electus** *Wheeler and Mel.*, Biol. Cent.-Am., 1901, Dipt. Suppl.  
Eight specimens.
- Edalea ohioensis** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 256.  
One specimen.
- Leptopeza disparilis** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 258.  
One specimen.
- Brachystoma occidentalis** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 260.  
Five specimens.
- Hormopeza bullata** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 274.  
Two specimens.
- Hilara bella** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 271.  
One specimen.

- Hilara congregaria** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 272.  
Four specimens.
- Hilara nugax** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 273.  
Eight specimens.
- Hilara baculifer** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 271.  
Four specimens.
- Hilara carbonaria** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 272.  
Two specimens.
- Hilara wheeleri** *Mel.*, Psyche, 1901, p. 214.  
Five specimens.
- Ragas mabelæ** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 277.  
One male.
- Iteaphila peregrina** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 331.  
Four specimens.
- Lampremis chichimeca** *Wheeler and Mel.*, Biol. Cent.-Am., Dipt. Suppl., 1901, p. 368.  
Four specimens.
- Empimorpha geneatis** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 329.  
One specimen.
- Empis asema** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 294.  
Three specimens.
- Empis dolorosa** *Wheeler and Mel.*, Biol. Cent.-Am., Dipt. Suppl., 1901, p. 370.  
One specimen.
- Empis annulipes** *Wheeler and Mel.*, Biol. Cent.-Am., Dipt. Suppl., 1901, p. 369.  
Three specimens.
- Empis johnsoni** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 303.  
Three specimens.
- Empis enodis** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 303.
- Empis cacuminifer** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 304.  
Four specimens.
- Empis aldrichii** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 309.  
One specimen.
- Empis cæligena** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 314.  
Four specimens.
- Empis teres** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 315.  
Five specimens.
- Empis gladiator** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 316.  
Four specimens.

- Empis arthritica** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 318.  
Four specimens.
- Empis aërobatica** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 323.  
Three specimens.
- Empis nodipes** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 324.  
One specimen.
- Empis dolabraria** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 325.  
Two specimens.
- Empis dolabraria** var. **disconvenita** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 326.  
Two specimens.
- Empis falcata** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 326.  
Two specimens.
- Empis canaster** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 326.  
Four specimens.
- Empis mixopolia** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 327.  
Four specimens.
- Empis æripes** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 328.  
Four specimens.
- Empis podagra** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 318.  
Three specimens.
- Holoclera bilineata** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 334.  
Three specimens.
- Holoclera sycophantor** *Mel.*, Trans. Am. Ent. Soc., Vol. XXVIII, 1902, p. 334.  
Three specimens.

## DOLICHOPODIDÆ.

- Dolichopus aldrichii** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 3.  
Twelve specimens.
- Dolichopus consanguineus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 5.  
Twelve specimens.
- Dolichopus incongruus** *Wheeler*, Psyche, Vol. V, 1890, p. 338.  
One specimen.
- Dolichopus flagellitenens** *Wheeler*, Psyche, Vol. V, 1890, p. 339.  
Two specimens.
- Dolichopus germanus** *Wheeler*, Psyche, Vol. V, 1890, p. 341.  
Nine specimens.

- Dolichopus consanguineus** var. **propinquus** *Mel. and Brues*, Biol. Bull., Vol. I, 1900, p. 132.  
One specimen.
- Dolichopus sincerus** *Mel.*, Can. Ent., Vol. XXXII, 1900, p. 136.  
One specimen.
- Dolichopus misellus** *Mel.*, Can. Ent., Vol. XXXII, 1900, p. 136.  
Three specimens.
- Dolichopus calainus** *Mel. and Brues*, Biol. Bull., Vol. I, 1900, p. 138.  
One specimen.
- Dolichopus agronomus** *Mel. and Brues*, Biol. Bull., Vol. I, 1900, p. 140.  
One specimen.
- Dolichopus pernix** *Mel. and Brues*, Biol. Bull., Vol. I, 1900, p. 141.  
One specimen.
- Dolichopus intentus** *Mel. and Brues*, Biol. Bull., Vol. I, 1900, p. 137.  
One specimen.
- Dolichopus enigma** *Mel. and Brues*, Biol. Bull., Vol. I, 1900, p. 139.  
One specimen.
- Dolichopus latipes** var. **cognatus** *Mel. and Brues*, Biol. Bull., Vol. I, 1900, p. 129.  
Two specimens.
- Dolichopus wheeleri** *Mel. and Brues*, Biol. Bull., Vol. I, 1900, p. 126.  
One specimen.
- Dolichopus idahoensis** *Ald.*, Kansas Univ. Quart., 1894, p. 154.  
Three specimens (cotypes).
- Gymnopternus poenitens** *Wheeler*, Psyche, Vol. V, 1890, p. 355.  
Two specimens.
- Gymnopternus mirificus** *Mel.*, Can. Ent., Vol. XXXII, 1900, p. 135.  
Three specimens.
- Polymedon castus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 6.  
One specimen.
- Hercostomus impudicus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 10.  
Two specimens.
- Hercostomus anarmastus** *Mel.*, Can. Ent., Vol. XXXII, 1900, p. 139.  
One specimen.
- Hercostomus vetitus** *Mel.*, Can. Ent., Vol. XXXII, 1900, p. 138.  
One specimen.
- Hercostomus procerus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 8.  
Ten specimens.
- Pelastoneurus neglectus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 12.  
Two specimens.

- Pelastoneurus occidentalis** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 13.  
Five specimens.
- Pelastoneurus dissimilipes** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 16.  
Five specimens.
- Pelastoneurus cyaneus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 17.  
Seventeen specimens.
- Pelastoneurus pictipennis** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II., 1899, p. 14.  
Four specimens.
- Pelastoneurus floridanus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 13.  
Ten specimens.
- Pelastoneurus wheeleri** *Mel.*, Can. Ent., Vol. XXXII, 1900, p. 140.  
One specimen.
- Paraclius hybridus** *Mel.*, Can. Ent., Vol. XXXII, 1900, p. 14.  
Nine specimens.
- Paraclius propinquus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 18.  
Two specimens.
- Medeterus princeps** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 25.  
Three specimens.
- Medeterus appendiculatus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 29.  
One specimen.
- Medeterus xerophilus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 28.  
Eight specimens.
- Medeterus californicus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 27.  
Eight specimens.
- Medeterus aberrans** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 22.  
One specimen.
- Medeterus aurivittatus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 29.  
Five specimens.
- Medeterus viduus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 24.  
One specimen.
- Medeterus aldrichii** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 24.  
One specimen.

- Medeterus petulcus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 21.  
One specimen.
- Medeterus maurus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 23.  
Four specimens.
- Medeterus cyanogaster** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 27.  
Six specimens.
- Thrypticus willistoni** *Wheeler*, Psyche, Vol. V, 1890, p. 376.  
Eleven specimens.
- Thrypticus fraterculus** *Wheeler*, Psyche, Vol. V, 1890, p. 376.  
Seven specimens.
- Asyndetus syntormoides** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 32.  
One specimen.
- Porphyrops xipheres** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 34.  
One specimen.
- Porphyrops effilatus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 34.  
One specimen.
- Synarthrus stratægus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 39 (= *Syntromon stratægus*).  
Four specimens.
- Synarthrus affinis** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 38 (= *Syntormon affinis*).  
Thirteen specimens.
- Parasyntormon montivagum** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 46.  
Ten specimens.
- Parasyntormon emarginatum** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 45.  
Eight specimens.
- Parasyntormon lagotis** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 43.  
Five specimens.
- Parasyntormon asellus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 42.  
Twelve specimens.
- Parasyntormon hinnulus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 44.  
Two specimens.
- Sympycnus pugil** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 51.  
One specimen.

- Sympycnus marcidus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 48.  
Twelve specimens.
- Sympycnus cuprinus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 50.  
Ten specimens.
- Nothosympycnus sobrinus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 54.  
One specimen.
- Nothosympycnus oreas** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 55.  
One specimen.
- Nothosympycnus fortunatus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 52.  
One specimen.
- Nothosympycnus vegetus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 53.  
Ten specimens.
- Tachytrechus protervus** *Mel.*, Can. Ent., Vol. XXXII, 1900, p. 143.  
Two specimens.
- Diaphorus sutrapa** *Wheeler*, Psyche, Vol. V, 1890, p. 359.  
One specimen.
- Diaphorus rauterbergi** *Wheeler*, Psyche, Vol. V, 1890, p. 360.  
One specimen.
- Diaphorus palpiger** *Wheeler*, Psyche, Vol. V, 1890, p. 360.  
Three specimens.
- Chrysotus choricus** *Wheeler*, Psyche, Vol. V, 1890, p. 357.  
Two specimens.
- Chrysotus pratincola** *Wheeler*, Psyche, Vol. V, 1890, p. 357.  
One specimen.
- Chrysotus wisconsinensis** *Wheeler*, Psyche, Vol. V, 1890, p. 356.  
Eight specimens.
- Pelorocephalus salax** *Wheeler*, Psyche, Vol. V, 1890, p. 374.  
Five specimens.
- Teuchophorus clavigerellus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 57.  
One specimen.
- Campsicnemus degener** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 58.  
Eleven specimens.
- Campsicnemus philoctetes** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 59.  
Six specimens.
- Campsicnemus œdipus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 60.  
Ten specimens.

- Campsicnemus thersites** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 61.  
Twelve specimens.
- Parhydrophorus canescens** *Wheeler*, Ent. News, Vol. VII, 1896, p. 187.  
Eleven specimens.
- Hydrophorus algens** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 63.  
Four specimens.
- Hydrophorus eldoradensis** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 65.  
Fourteen specimens.
- Hydrophorus philombrius** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 65.  
Four specimens.
- Hydrophorus agalma** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 66.  
Two specimens.
- Hydrophorus magdalenæ** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 67.  
Five specimens.
- Hydrophorus sodalis** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 68.  
Ten specimens.
- Xiphandrium americanum** *Wheeler*, Ent. News, Vol. VII, 1896, p. 155.  
Three specimens.
- Thinophilus pectiniger** *Wheeler*, Ent. News, Vol. VII, 1896, p. 155.  
Three specimens.
- Thinophilus neglectus** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 70.  
Three specimens.
- Aphrosylus grassator** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. I, 1897, p. 149.  
Three specimens.
- Aphrosylus direptor** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. I, 1897, p. 148.  
Five specimens.
- Aphrosylus prædator** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. I, 1897, p. 146.  
Fifteen specimens.
- Neurigona floridula** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 72.  
One specimen.
- Neurigona lienosa** *Wheeler*, Proc. Calif. Acad. Sci., 3d Ser., Vol. II, 1899, p. 73.  
One specimen.



## EPHYDRIDÆ.

**Ochthera lauta** *Wheeler*, Ent. News, Vol. VII, 1896, p. 121.

One specimen.

## PHORIDÆ.

**Phora multiseriata** *Brues*, Trans. Am. Ent. Soc., Vol. XXIX, 1903,  
p. 345.

One specimen.

**Phora nitidifrons** *Brues*, Trans. Am. Ent. Soc., Vol. XXIX, 1903,  
p. 347.

Three specimens.

**Aphiochæta magnipalpis** *Ald.*, Trans. Ent. Soc. London, 1896, p. 348.  
One specimen.

**Aphiochæta aurea** *Ald.*, Trans. Ent. Soc. London, 1896, p. 347.  
Two specimens.

**Trineura montana** *Brues*, Trans. Am. Ent. Soc., Vol. XXIX, 1903, p.  
378.

Two specimens.

## CECIDOMYIDÆ.

**Cecidomyia symmetrica** *O. S.*, Mon. Dipt. N. Am., Pt. I, 1862, p. 200.  
Gall only.

**Cecidomyia sanguinolenta** *O. S.*, Mon. Dipt., N. Am., Pt. I, 1862, p. 192.  
Gall only.

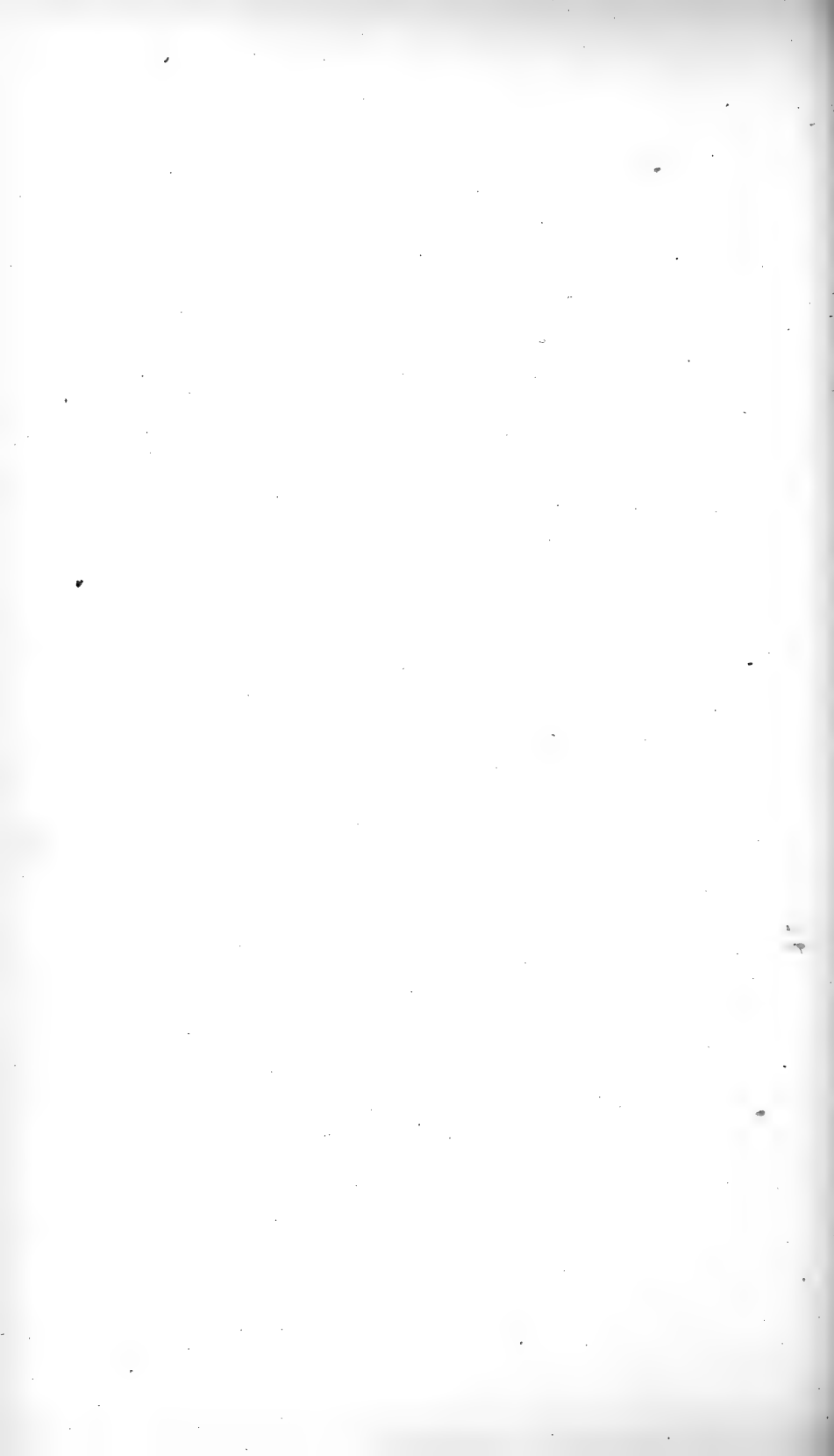
**Cecidomyia ocellaris** *O. S.*, Mon. Dipt. N. Am., Pt. I, 1862, p. 199.  
Gall only.

**Cecidomyia strobiloides** *O. S.*, Mon. Dipt. N. Am., Pt. I, 1862, p. 203.  
Gall only.

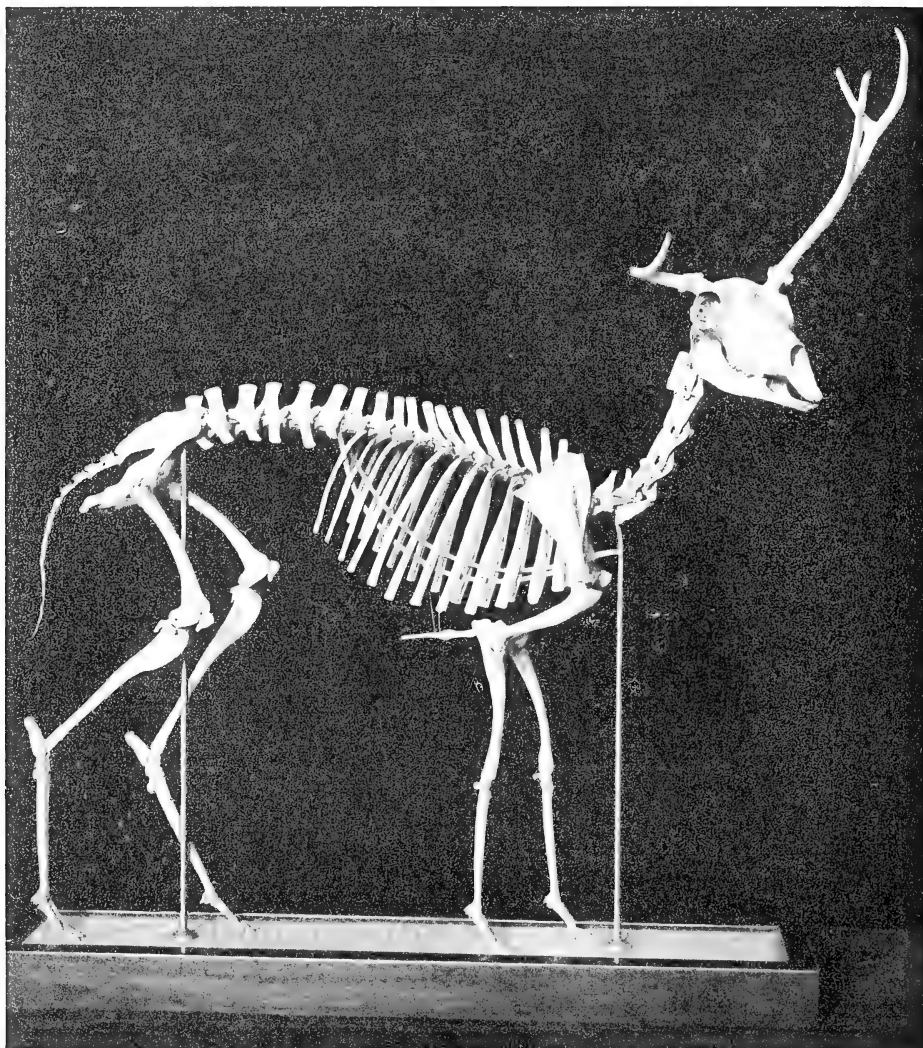
**Cecidomyia tubicola** *O. S.*, Mon. Dipt. N. Am., Pt. I, 1862, p. 192.  
Gall only.

**Cecidomyia caryæcola** *O. S.*, Mon. Dipt. N. Am., Pt. I, 1862, p. 192.  
Gall only.

**Cecidomyia holotricha** *O. S.*, Mon. Dipt. N. Am., Pt. I, 1862, p. 193.  
Gall only.







MOUNTED SKELETON OF MERYCODUS OSBORNI.

A little less than one seventh of the natural size. Height at withers, 19 inches; length of antler, 9 inches. Type specimen.

## Article VII.—A COMPLETE SKELETON OF MERYCODUS.

By W. D. MATTHEW.

### PLATE III.

The following description is based on a nearly complete skeleton, very perfectly preserved, found in the Middle Miocene (Pawnee Creek Beds) of northeastern Colorado, by Mr. Barnum Brown of the American Museum Expedition of 1901. The expense of this expedition was defrayed by the generosity of the late Mr. W. C. Whitney. My special acknowledgments are due to Professor Osborn for the privilege of describing this very pretty and interesting animal.

Two groups of the higher ruminants (Pecora) are found in the American Miocene, each combining characters now peculiar to distinct families. The first includes small hypsodont species related to the antelopes, but with branching, deciduous antlers like those of the deer. The second includes brachydont species, mostly of large size, related to the deer, but with horn-cores or antlers unbranched, probably non-deciduous.<sup>1</sup> The hypsodont group includes *Merycodus* (= *Cosoryx*) and the true *Blastomeryx*; the brachydont includes a number of species which have been variously referred to *Dicrocerus*, *Blastomeryx*, and *Palæomeryx*, and which I leave provisionally under the last-named genus. Neither group can be regarded as directly ancestral to any modern animals; they represent side branches which have not survived.

Most authors have grouped these Miocene genera, along with the European *Palæomeryx*, *Dicrocerus*, *Amphitragulus*, and *Dremotherium*, under the Cervidæ, either as allied to the Muntjac (*Cervulus*) or without particularizing their position. Schlosser refers the European genera to a distinct family, the Palæomerycidæ<sup>2</sup>; and would no doubt refer the brachydont American species with them. In view of the relationship of

<sup>1</sup> But the evidence in regard to this point is not positive.

<sup>2</sup> Proposed by Lydekker in 1883, without definition.—Ind. Tert. and Post. Tert. Vert., II, v, p. 32.

*Merycodus* with *Antilocapra*, as shown by Professor Scott in 1890 and abundantly confirmed by the complete skeleton here described, it is necessary to separate *Merycodus* and *Blastomeryx* from the Cervidæ and place them as a distinct family or as a subfamily of Antilocapridæ. The former course seems best to express their relationships as at present understood, for the one definite character (the nature of the horns) which separates Antilocapridæ from Bovidæ is not more important than the horn distinction which separates *Merycodus* from either group. Nevertheless, in the writer's opinion, the clearness of this distinction will be broken down when we have a better knowledge of the various allied fossil types, and it will probably then be necessary to unite Merycodontidæ and Antilocapridæ into a single family.

Assuming for the present that the Merycodonts are entitled to rank as a family, the classification will be as follows:

Boöidea	{	typica	{	Bovidæ	{ Bovinæ. Caprinæ. Antilopinæ, etc.
				Antilocapridæ.	
				MERYCOPONTIDÆ, fam. nov.	
				Giraffidæ	{ Sivatheriinæ. Giraffinæ.
	{	cerviformia	Cervidæ	{	Palæomerycinæ, Moschinæ. Cervulinæ. Cervinæ.

BOÖIDEA TYPICA. Teeth hypsodont, premolars reduced, basifacial axis highly inclined to basicranial. Lateral toes much reduced or absent. Horns usually supra-orbital.

*Bovidæ*. Permanent unbranched horns.

*Antilocapridæ*. Deciduous horns with permanent cores.

*Merycodontidæ*. Deciduous branching antlers.

*Giraffidæ*. Rudimentary permanent horns of primitive type.

BOÖIDEA CERVIFORMIA. Teeth brachyodont, premolars large, basifacial axis nearly parallel to basicranial. Lateral toes usually better developed than in preceding group. Horns postorbital.

*Cervidæ*. Deciduous branching antlers.

The Giraffidæ do not, in fact, fit very well into either of these divisions, being largely an intermediate group. They are regarded by authors as referable rather to the typical Boöidea than to the deer.

## MERYCODONTIDÆ, fam. nov.

1. **MERYCODUS.** Molars, especially  $m_3$ , hypsodont. Antlers of two or three tines, without brow tine, forking dichotomously or nearly so. Lateral toes greatly reduced, distal rudiments with phalanges only, no trace being left of metapodials.

*M. necatus.*  $P_2$  very small, teeth much compressed, antler forked near base. Upper Miocene.

Type, a lower jaw from Bijou Hill, Missouri River. Another specimen figured by Leidy, has  $p_2-m_3$ , 53 mm. Antlers and associated jaws from New Mexico, figured by Cope. Upper Miocene.

No. 9825, lower jaw from Little White River, South Dakota.

Probably *Cervus warreni* Leidy can be referred here.

*M. furcatus.* Teeth as in preceding species, antler forked high up.  $P_2-m_3$ , 55 mm. Upper Miocene.

Type (*Cosoryx furcatus*), an antler from Niobrara River figured by Leidy. Antlers and associated jaws from New Mexico figured by Cope.

Restoration of the skeleton figured by Scott.

No. 8497, back of skull with antlers and parts of skeleton. Nebraska.

*M. osborni, sp. nov.*  $P_2$  larger, teeth less compressed, antler forked high up, flattened at fork.  $P_2-m_3$ , 50 mm. Middle Miocene.

Type, No. 9476, complete skeleton, mature. Colorado.

No. 9475, fragmentary skeleton, young adult. Colorado.

Nos. 9473, 9474. Feet, etc. Colorado.

*M. ? ramosus.* Teeth shorter-crowned,  $p_2$  larger, molars with basal tubercle between external columns.  $P_2-m_3$ , 50 mm. Upper Miocene.

Type, antler and jaw (association doubtful) from New Mexico.

No. 8561, lower jaw, from Nebraska.

*M. teres* { Large species, teeth not known, of entirely uncertain position. Upper Miocene.  
" *trilateralis* {

2. **BLASTOMERYX.** Teeth less hypsodont, molars with anteroexternal cingular cusp, and basal tubercle between external columns.

*B. gemmifer.* Smaller than any of the above species,  $p_2-m_3$ , 42 mm. Middle Miocene.

Type, a lower molar, Am. Mus. No. 8301, from Colorado.

No. 9449, lower jaw, hind leg, etc., from Colorado.

*B. wellsi, sp. nov.* Larger than *B. gemmifer*, premolars more reduced.  $P_2-m_3$ , 1150 mm. Upper Miocene.

Type, a lower jaw, No. 9823, from Little White River, South Dakota.

3. CAPROMERYX. Teeth more hypsodont, crowns as long as in *Antilocapra*, but retaining in part the more primitive premolar pattern of *Merycodus* and *Blastomeryx*. Only the lower jaw is known. Pleistocene.

*C. furcifer*. Size of *Merycodus*.  $P_2-m_3$ , 52 mm.

Type, No. 2771, lower jaw, from Hay Springs, Nebraska. Pleistocene.

#### ANTILOCAPRIDÆ.

*Antilocapra americana* is the only species generally recognized. Pleistocene and Recent.

#### CERVIDÆ.

PALÆOMERYX. Teeth very brachydont, with accessory basal cusps on molars, and "Palæomeryx fold" on lower molars. Typical species supposed to have been hornless, but referred species bear simple antlers. Three premolars in upper and in lower jaw.

*P. kaupi*, *P. bojani*, *P. eminens*. Large species, considered on very uncertain evidence to have been hornless.

*P. meyeri*. Smaller, with simple antlers.

The above species are from the Miocene of Europe. The American species provisionally referred to the genus are:

- P. borealis* Cope.  $P^2-m^3$ , 79 mm. Antlers supra-orbital, and, as far as known, unbranched, without burr (hence ? non-deciduous), velvet-covered.

Type, a horn and part of a skull from the Deep River Beds (Smith Creek), Montana, No. 8132. Skulls and various fragments of skeletons from the same horizon and locality, and jaws and fragments of skeleton from Pawnee Buttes, Colorado, are referred to this species.

*P. antilopinus* Scott.  $P^2-m^3$ , 79 mm. Type, a skull and fragmentary skeleton from the same locality as the type of *P. borealis*.

*P. americanus* Douglass.  $P_2-m_3$ , 80 mm. Size of preceding species, with which the describer thinks it may be identical.

Type, a lower jaw.

*P. madisonius* Douglass. About ten percent larger than the preceding species.

Type, part of a lower jaw with three true molars.

Other larger and smaller species are indicated by fragmentary material in the American Museum and other collections, but I refrain from naming them until more complete specimens are available.



### *Merycodus* Leidy.

This genus has been described from antlers and jaws by Leidy and Cope, and from incomplete skeletons by Scott and Douglass. The study of the complete skeleton and various fragmentary skeletons in the American Museum collections, and the excellent figures and descriptions of the authors above named enable us to present a fairly complete idea of its characters. Following is a summary of the more important ones:

1. Antlers supra-orbital, deciduous, branched, three-tined in mature, two-tined in younger adult, probably single-tined or absent in earlier stages. Branching dichotomous or nearly so, brow tine absent. Antlers provided with burr.
2. Skull with basifacial axis much depressed on basicranial. Cranium shortened, orbits very prominent.
3. Teeth hypsodont, most nearly resembling those of *Antilocapra*, but retaining certain primitive characters.
4. Lateral toes on both fore and hind feet represented by tiny vestiges of the three phalanges.
5. Detailed characters of vertebræ and limb bones nearest to *Antilocapra*, but somewhat less specialized in most respects.

The above is a curious combination of deer and antelope characters. Two explanations offer: Either *Merycodus* was a deer which paralleled the antelopes in every detail of its skeleton structure, skull, and teeth, or else it was, like *Antilocapra*, an antelope separated from the main line at a date sufficiently early for it to have developed a distinct type of horn structure, namely, antlers in place of deciduous or permanent horns. The former view involves a parallelism too exact and uniform between unrelated types to be at all probable. If the latter view be taken we must regard *Merycodus*, *Antilocapra*, and the true antelopes as representing three branches of a primitive stock, divergent in horn structure, but parallel in other characters. In theory, if *Antilocapra* deserves to be placed in a family separate from the antelopes and Bovidæ, *Merycodus* has an equal claim. But the various imperfectly known related types from the Loup Fork and Pleistocene of the West are more or less intermediate, and combine in varying degree characters now peculiar to deer, antelopes, and

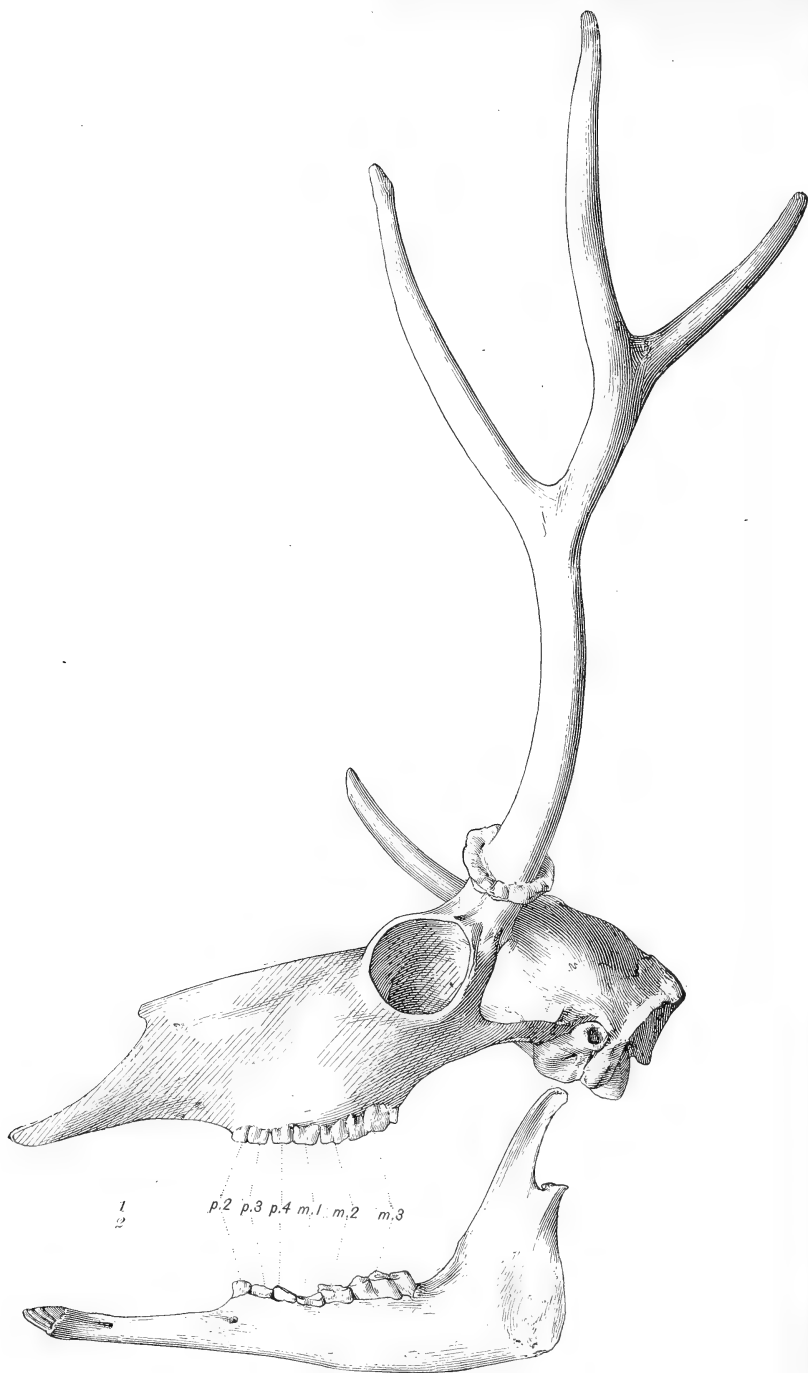


Fig. 1. *Merycodus osborni*. Side view of skull and lower jaw, half natural size. Type specimen, Middle Miocene, Colorado. The anterior part of the skull is mostly restored in plaster, indicated in the drawing by cross-hatching, and the face has been made too long and too heavy.

pronghorns. The most convenient arrangement seems to be to leave the very brachydont types, with their European allies, in the Cervidæ, and to consider *Merycodus* with its allies, *Blastomeryx* and *Capromeryx*, all hypsodont types, with reduced premolars, high basifacial angle, and unquestionable antelopine affinities in skeleton details, either as a distinct family, or a subfamily of Antilocapridæ.

***Merycodus osborni*, sp. nov.**

*Type*, a nearly complete mounted skeleton, No. 9476, from the Middle Miocene (Pawnee Creek Beds) of northeastern Colorado.

*Cotype*, a fragmentary skeleton, No. 9475, from the same formation and locality.

CHARACTERS: *Antlers* three-tined in mature, two-tined in a younger adult, bifurcate some distance above burr, and the posterior branch again bifurcate; considerably flattened and expanded at each bifurcation.

*Teeth* less compressed than in *M. furcatus* and *M. necatus*, premolar not reduced in size.

*Fore and Hind feet* with vestiges of lateral phalanges, but none of the lateral metapodials.

The principal characters of this species are derived from the nearly complete skeleton of an individual in which the molars are very much worn. The first true molar in each jaw is worn down to the roots, and the others correspondingly. This specimen gives the characters of the species in maturity. The second skeleton has the antlers, upper and lower jaws, fore and hind feet, and some limb-bones and vertebræ in good preservation, and after a careful comparison of all these parts I have no hesitation in placing it in the same species, especially as it is from the same horizon and locality. It is of a younger but adult individual, the last molar being fully protruded and moderately worn.

SKULL.—The muzzle anterior to the orbits had been exposed and weathered out when found, and is represented only by a few fragments, including most of the teeth and nasal bones. There is therefore some margin of uncertainty as to just how much the *basifacial axis* is inclined to the basicranial axis, but the angle was certainly not less than in *Antilocapra*,

and appears to have been somewhat greater. The *orbits* are large, very prominent, and wide apart, directed chiefly laterally and a little upward. I have seen no modern ruminant skulls in which the orbits are quite so prominent. The *antlers* are the most striking feature of the skeleton; they project from the upper posterior corner of the orbit as in *Antilocapra*



Fig. 2. *Merycodus osborni*. Superior view of skull and antlers, half natural size. Type specimen.

and most of the true antelopes, not from the cranial vault as in the deer. One of them has sustained an injury during the lifetime of the animal; the uninjured antler is directed outward, backward, and upward about equally, being thus intermediate in direction between antelope horns and deer antlers. Its total length on the curve is 300 mm., or approximately one and two thirds the length of the skull. A burr at

18 mm. from the base divides the beam from the stock, but there is no distinction in texture between the two, and where parts of the burr were removed during the preparation of the specimen, it was impossible to determine where the burr had been from any mark, scar, or change of texture on the beam beneath. The beam continues without branching for 100 mm., curving upwards; it then forks into two almost equal branches, the upper and somewhat smaller branch continuing simple to a length of 120 mm., the lower forking again at a distance of 55 mm. into anterior and posterior tines. The smaller posterior tine projects backward and upward to a length of 65 mm., having some upward curvature; the larger anterior tine projects upward 87 mm., with a strong inward and backward curvature. These distances are measured on the chord of the arc, except the total length of the antler. At each bifurcation the antler is considerably flattened and spread; elsewhere it is round-oval in section.

The right antler has been injured during the lifetime of the animal, with the result that the beam is smaller than the left,

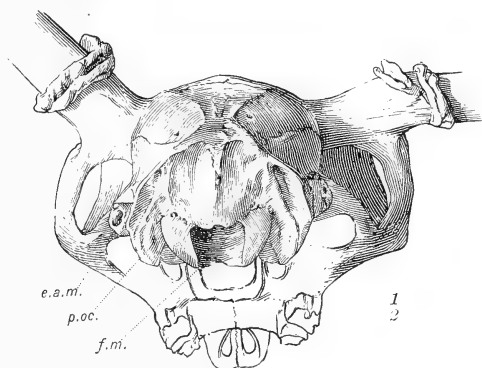


Fig. 3. *Merycodus osborni*. Posterior view of skull showing injured right antler. Type specimen.

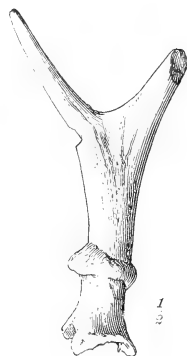


Fig. 4. *Merycodus osborni*. Antler of right side of cotype, No. 9475. External view, half natural size.

bent down so as to project horizontally outward, and forked at 55 mm. from the burr, the upper branch the smaller. The main branch is broken off just beyond the fork; this probably occurred after death. But to judge from appearances, the

whole antler was dwarfed by the injury during life, which is also indicated by a second burr formed proximally to the normal burr, and encircling obliquely the upper part of the stock, becoming continuous with the normal burr on the under side. Probably the injury bent down the antler, breaking the stock, or at least the upper part of it, just within the burr, but leaving the velvet unbroken. A second burr would naturally be formed proximal to the break after it was repaired, and meantime the blood supply would be checked to some extent and the size of the antler correspondingly dwarfed.

The cotype illustrates a younger stage in the ontogeny of the antler, which is about 70 mm. in length, the beam flattening and forking at a distance of 40 mm. into two nearly equal tines, each about 40 mm. long.

The *frontals* in the type are strongly convex from side to side as well as anteroposteriorly—more convex than in the young pronghorn, which offers the nearest comparison. This convexity and the large, strongly projecting orbits accentuate the hollow in which the supra-orbital foramina are set, antero-internal to the bases of the antlers.

The *cranium* is short, as in the antelopes, apparently more inclined to the basifacial axis than in *Antilocapra*, certainly much more so than in the deer, resembling the true antelopes most nearly in this respect. The auditory bulla is much larger than in the pronghorn, almost as large as in the gazelle, and the posterior part of the zygomatic arch is less reduced in length than in *Antilocapra*. In both these respects *Merycodus* approximates the young *Antilocapra* more than it does the adult, and probably retains more of the primitive characters of the group.

Another cranium of a different species (*M. furcatus*), coming from a higher horizon, illustrates the characters of a younger individual. In this the antlers are about as much developed as in the cotype of *M. osborni*, but judging from the cranial sutures and epiphyses of the bones, the individual was considerably younger; the teeth unfortunately are not preserved. These antlers correspond almost exactly in form and size with the typical antler of *M. (Cosoryx) furcatus*, except that the

burr is present. They are placed nearly over the orbit and directed upward; also they are less flattened out at the bifurcation than in *M. osborni*, and the beam is longer than in the younger individual of that species. The cranium, compared with the mature type cranium of *M. osborni*, shows less prominent occipital crests, the occiputsloping forward rather than backward. The frontals are less arched, the orbits less prominent, the distance between the glenoid and occipital condyles is greater, and the tympanic bulla is larger. All the cranial differ-

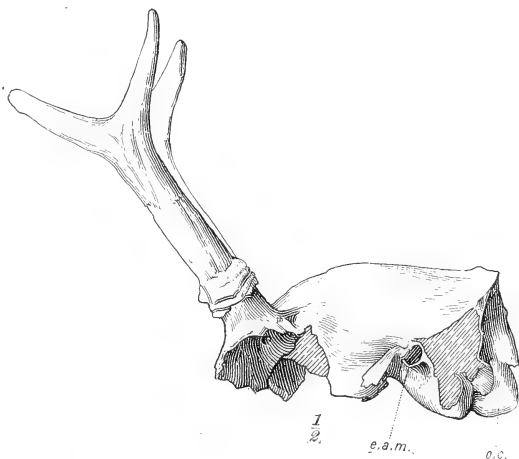


Fig. 5. *Merycodus furcatus*. Skull and antlers, side view, half natural size. No. 8497, Upper Miocene, Republican River Basin, Nebraska.

ences appear to me due to the *furcatus* skull having belonged to a younger animal. All are shown by young antelopes and pronghorns when compared with older individuals of the same species; in all of them the mature *M. osborni* approaches *Antilocapra*, and especially the young *Antilocapra*, more nearly than does the young *Merycodus* from the later Miocene, and departs further from the primitive Cervid characters. The true specific distinctions between *M. osborni* and *M. furcatus* are noted elsewhere in this paper.

A still younger specimen of *Merycodus* is the skull and fragmentary skeleton described by Douglass under the name of *Cosoryx agilis*. This individual was immature, the last molars not yet fully protruded, and the milk dentition just about to be shed. The epiphyses of this specimen, which Mr. Douglass kindly permitted me to examine, are mostly separate. There are no antlers, for which reason Mr. Douglass considers it a female, but it is not improbable that the antlers would not

have appeared in the male at this time of life, so that the sex is indeterminate. The convexity of the frontals behind the orbits is not so great as in the *M. osborni* type. The occipital crests are less prominent, the occiput slopes more forward, the



Fig. 6. *Merycodus furcatus*. Skull seen from above, one half natural size. No. 8497, Upper Miocene, Republican River Basin, Nebraska.

orbits are not so wide, the bulla is larger, and the whole appearance of the skull more primitive than in the young adult *M. furcatus*, mentioned above, thus illustrating an earlier stage in the development of the skull. Its horizon is probably about the same as that of *M. furcatus*, later than that of *M. osborni*.

To sum up the above skull characters: The antlers are three-tined in the mature animal and two-tined at a younger adult stage, probably unbranched or absent in juvenile stages. They have no brow tine, and branch dichotomously at some distance from the base, the inferior branch again forking. They were deciduous, quite probably annually renewed. All that have been found are smooth-surfaced, as though covered by velvet during life; this condition is also indicated by the character of the burr in all known specimens; this may be best explained by supposing that these deer frequented the plains and watercourses only in spring and summer, while the antlers were still in the velvet, and that during the autumn and winter, when the antlers would be bare, they retired to the higher land, where, of course, their remains are not preserved, on account of the absence of sediment in which they could become buried.<sup>1</sup>

The skull shows progress from the little-altered cervine type towards (and in some respects beyond) the more specialized

<sup>1</sup> I am indebted to Mr. Madison Grant for this suggestion.



pronghorn and antelope type, in the shortening of the cranial region, reduction of the bullæ, bending down of the facial region, and prominence of the orbits. In the last two characters *Merycodus* is more specialized than *Antilocapra*, and the young *Merycodus* resembles the adult *Antilocapra*; in the first two, *Antilocapra* is the more specialized, and the adult *Merycodus* resembles the young *Antilocapra*.

*Teeth.* — The teeth of *Merycodus* have been carefully and accurately described by Leidy, Cope, and Scott, so that it is unnecessary to give a full description here. Their most important characteristics are as follows:

Molars and premolars much more hypsodont than in any Cervidæ, considerably less so than in *Antilocapra* and most true antelopes. The anterior premolars and anterior molars are less hypsodont in

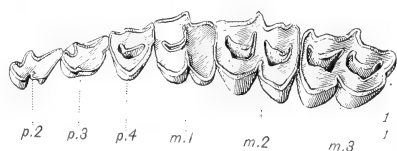


Fig. 7. *Merycodus osborni*. Upper teeth, crown view, natural size. No. 9475. Middle Miocene, Colorado.

proportion to the posterior ones than in the pronghorn, and the milk teeth are comparatively short-crowned. The lower premolars retain the ancient pattern much as is seen in *Leptomeryx* and *Poebrotherium*, their internal ribs being separated by open valleys, instead of uniting to enclose a

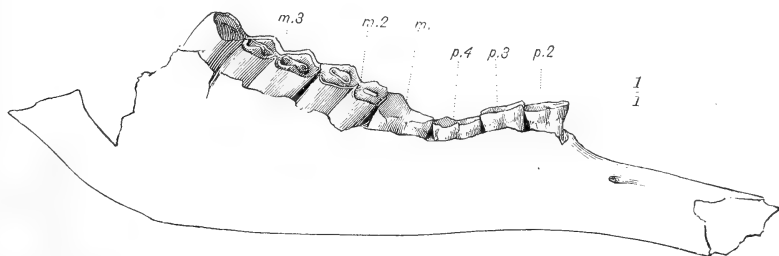


Fig. 8. *Merycodus osborni*. Lower jaw, external view, natural size. No. 9475. Middle Miocene, Colorado.

fossa, as they do for the most part in *Antilocapra* and the true antelopes. This primitive condition is largely retained in the Cervidæ, but the form of their premolars is  
March, 1904.]

quite different. It appears in the second and third milk premolars of *Antilocapra*, although lost in the permanent teeth. In the *Merycodus* teeth here figured the premolars are too much worn to show this character, but it is equally seen in *Blastomeryx* and *Capromeryx*, and may be observed in figures 18 and 20. The upper premolars show an analogous incompleteness in the inner crescents, except of the fourth.

VERTEBRÆ. — *Atlas*. Length the same proportionately as in *Antilocapra* and *Odocoileus*. The cotyli are wider than in either genus, the transverse wings more expanded anteriorly. In other respects it most resembles *Antilocapra*; the cotyli and the facets for the axis are continuous or ill-separated inferiorly, while in *Odocoileus* they are well separated; the foramen piercing the transverse wing is single, while in *Odocoileus* it is double superiorly.

*Axis*.—Longer in proportion than in pronghorn or deer, resembling rather the proportions in the gazelle. The spine is higher than in *Antilocapra*, especially anteriorly, but does

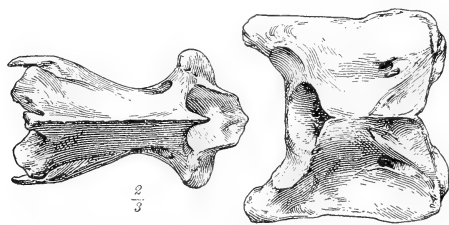


Fig. 9. *Merycodus osborni*. Atlas and axis viewed from above. Two thirds natural size. Type specimen.

not project so far forward. The inferior notch in the atlas facet is less marked than in the pronghorn, much less than in the deer, and is more like *Gazella*.

The vertebrarterial canal pierces the lamina of the neural arch, beginning anteriorly on the external surface a little anterior to the middle of the lamina, considerably behind the foramen for the second spinal nerve, and ending posteriorly on the internal surface of the lamina near its posterior border. In the deer this canal opens anteriorly into the nervous foramen and posteriorly on the posterior border of the lamina. In the antelopes it seems to be represented only by a very small canal, exterior in both openings; in *Cervulus* it opens anteriorly into the nervous foramen, and posteriorly on the external surface of the lamina. There seems to be in this respect a peculiar modification in

*Merycodus* of a primitive condition; but this is so inconstant a character that I should not think it of much importance. The transverse processes of the axis are stouter and shorter

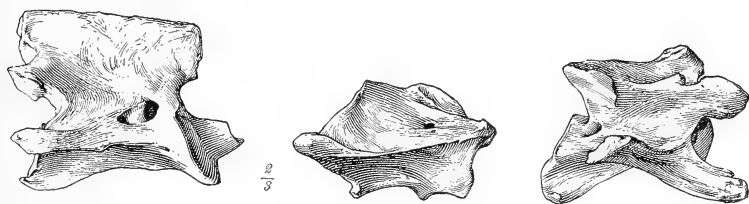


Fig. 10. *Merycodus osborni*. Atlas, axis, and fifth cervical vertebra, side views, two thirds natural size. Type specimen. (The cervical has by error been placed at the anterior end of the series, instead of behind the axis.)

in *Merycodus* than in either pronghorn or deer, and are directed more backwards.

*Third to Sixth Cervicals*.—Longer than in *Antilocapra* or *Odocoileus*, the inferior transverse lamina more extended into stout processes anteriorly and posteriorly, but not so wide. Superior lamina much as in *Antilocapra*, less developed than in *Odocoileus*, more than in *Gazella*. The neural spine of the fifth cervical is a rudimentary boss; that of the sixth is short but well formed, about 2 centimeters long. The vertebral canal extends from end to end of the lamina of the neural arch in all these cervicals, being longer (more complete) than in any of the genera named. *Gazella* comes nearest in this respect: *Odocoileus* is furthest removed.

*Seventh Cervical*.—Somewhat longer than in *Antilocapra*, which it rather closely resembles in form and proportions, but the centrum is smaller compared with the arch—smaller also than in *Odocoileus*, much smaller than in *Gazella*. The neural spine is more slender distally than in *Antilocapra*, and directed more backwards; the anterior zygapophysial facets are slightly concave, while in the deer they are strongly concave, and in the gazelle and muntjac convex. The transverse processes are very like those of *Antilocapra*.

*Anterior Dorsals*.—The spines are shorter, of more uniform width, and directed less backward than in *Antilocapra*, *Gazella*, or *Odocoileus*, approaching to some extent the muntjac and

other round-backed deer. The difference in size between dorsal and lumbar centra is less than in *Gazella*, somewhat less than in *Antilocapra*, but much more marked than in *Cervulus*.

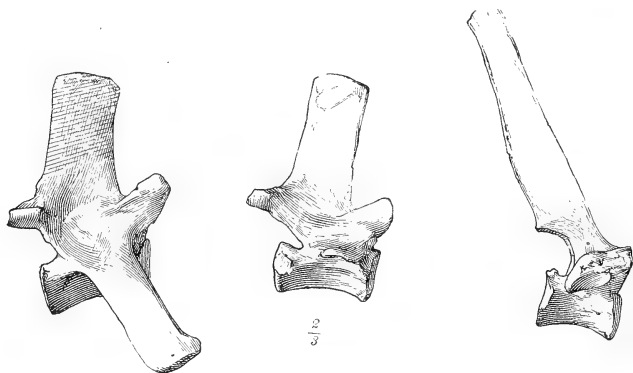


Fig. 11. *Merycodus osborni*. Fourth and twelfth dorsal and second lumbar vertebrae. Two thirds natural size. Type specimen.

*Lumbar*s.—The transverse processes are short, flat, and wide, the first (14th dorso-lumbar vertebra) well developed, so that the dorso-lumbar formula was probably invariably 13-6. The processes resemble those of *Cervulus* in their short, wide proportions, but are larger, and do not curve forward as in the muntjac, having the straightness and direction seen in *Antilocapra* and *Gazella*. The zygapophyses are smaller and less revolute than in the pronghorn. In *Gazella* they are smaller but somewhat more revolute; in *Odocoileus* more revolute and much larger; in *Cervulus* very much simpler.

To sum up the above vertebral characters: *Merycodus* is much more nearly related to *Antilocapra* than to any other living genus in the detailed characters of the vertebrae. The neck is longer, and adapted to carry the larger-antlered head. The back is not so straight as in the more advanced antelopes and deer, but by no means so rounded as in the muntjac. The vertebrae have a few minor specializations peculiar to the genus, but on the whole agree very well with the *Antilocapra* vertebrae, allowing for differences due to smaller size of the animal, its longer neck, and retention of primitive characters in the dorso-lumbar region. There is no indication of any

near relationship with the deer, and one cannot doubt that the position of *Merycodus* is with the Cavicornia, not with the Cervicornia, in spite of its branching, deer-like antlers.

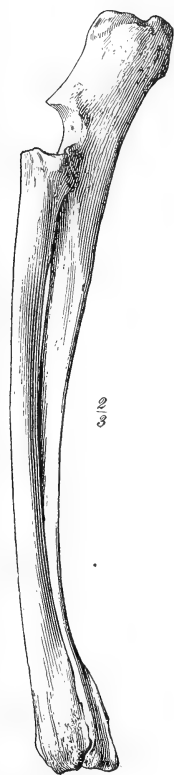


Fig. 12. *Merycodus osborni*. Ulna and radius, external view, two thirds natural size. Type specimen.

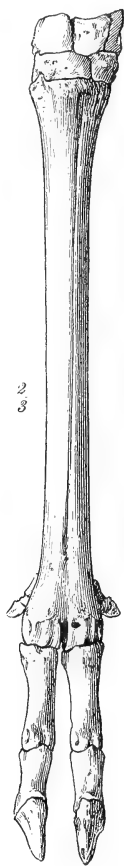


Fig. 13. *Merycodus osborni*. Anterior view of manus, two thirds natural size. Type specimen.

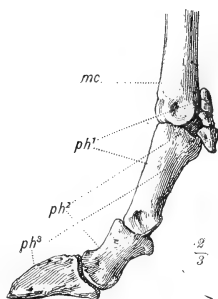


Fig. 14. *Merycodus osborni*. Distal end of manus, external view, two thirds natural size. No. 9475.

**FORE LIMB.** — The *scapula* is short and wide, with high spine and prominent coracoid process. *Antilocapra* is the nearest in these respects among the genera compared.

The *humerus* is intermediate between *Odocoileus* and *Antilocapra* in straightness of shaft, shortness and prominence of deltoid crest, and some other minor details.

The *ulna* and *radius* are entirely separate, as in the deer, not united along the shaft as in the antelopes; the shaft of the *ulna* is much more slender than in the deer, but not as slender as in the antelopes. The *olecranon* is somewhat longer and considerably thicker than in either *Antilocapra* or *Odocoileus*; the shafts of *ulna* and *radius* are rather strongly bowed forward, while those of *Antilocapra* are nearly straight. The curve is as great as that seen in *Odocoileus*; but in *Merycodus* the upper part of the shaft is most curved, in *Odocoileus* the lower part. In *Gazella* the shaft is straighter than in *Merycodus*, but, as in that genus, the upper part is the most curved. The *olecranon* of *Gazella* is like that of *Merycodus*.

The *carpus* is about ten per cent higher in proportion to its width than in *Antilocapra*, intermediate between that genus and *Odocoileus*. The *trapezium*, if present at all, must have been a small nodular bone without distinct facets on either the *magnum-trapezoid* or the *metacarpus*. The coössified proximal rudiments of *metacarpals* II and V are not very clearly distinguishable, although there is more trace of them left than in *Antilocapra*. In proportion to the size of the animal the *metacarpal* shaft is ten percent shorter, and wider than in *Antilocapra*, more concave inferiorly, the line of division between *metacarpals* III and IV clearly marked by a furrow from end to end, while in the modern genus it is almost obsolete. The furrow is present in *Odocoileus*, but less marked. The *phalanges* in *Merycodus* are shorter than in *Antilocapra*, but in form resemble them more than those of *Odocoileus*. The *unguals* are shorter and smaller than in the pronghorn, much smaller than in the deer.

The little rudimentary side toes are not preserved in the type specimen, or have been lost in extracting it from the matrix. In the cotype they are preserved in position in the fore foot, and are seen to consist of the distal half of the first phalanx, with the second and third complete. They are extremely small, their combined length about half that of the first phalanx of digit III or IV. The first rudiment lies just outside the first *sesamoid* series, and the others bend inward, backward, and downward from it. The upper end of the

first phalangeal rudiment is perfectly preserved, and shows that the upper end of the first phalanx was not calcified, and there is no trace left of the shafts or distal ends of the lateral metatarsals. The second and third lateral phalanges are well formed but very short, and with flat articular facets.

HIND LIMB. — *Pelvis*. The superior iliac fossa, lodging the gluteus medius, is more expanded than in any of the forms compared. There is, as in the deer, a deep pit on the inferior surface of the ilium just anterior to the acetabulum, close to the attachment of the rectus femoris, and perhaps serving to increase the area of attachment of this muscle. This is wanting in *Antilocapra*, much less marked in *Gazella*. The ischia and pubes are incomplete, but the parts preserved indicate that they were much like the corresponding parts in the pronghorn, the ischia wide, flattened, laterally expanded, with long, stout processes directed outward. There is a rather marked process on the inferior surface of the ischium, at the proximal end of the attachment of the quadratus femoris, rather more prominent than in *Antilocapra*. The pubic symphysis is shorter and thicker than in the pronghorn; the process for the pectineus is small, well defined, and separate as in the deer, not continued into the anterior border of the pubes as in the pronghorn and true antelopes.

The femora and proximal ends of the tibiae are missing in the type specimen, and also in the cotype. We do not know, therefore, what the proximal end of the fibula was like. The distal end is much reduced, the shaft represented by a very short, pointed, rudimentary spine at the upper end of the distal segment. This little spine lies in a proportionately short channel on the external border of the distal end of the tibia. The reduction of the fibula at this end is greater than in the pronghorn or gazelle, but less than in *Odocoileus*, *Cervus*, or any other deer that I have compared. The distal end of the fibula appears to be uniformly more reduced in the deer than in the antelopes: the proximal end, on the other hand, is much more reduced in the antelopes. *Merycodus* stands intermediate between the two groups in the reduction of the distal end of the fibula; as to the condition of the proximal end, we

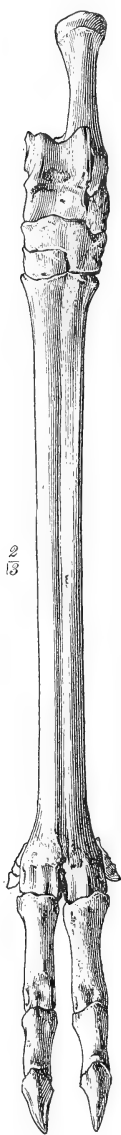


Fig. 15.  
*Merycodus osborni*. Anterior view of pes, two thirds natural size. Type specimen.

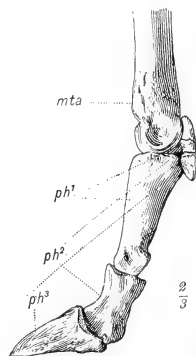


Fig. 16. *Merycodus osborni*. Distal end of pes, external view, two thirds natural size. No. 9475.

have unfortunately no evidence at present. The *tibia* does not appear to show any important distinctions from *Antilocapra*. The metatarsus is shorter in proportion; metatarsals III and IV are more clearly distinguishable than in *Antilocapra* or in *Odocoileus*. The second cuneiform (internal cuneiform, according to Scott) is larger than in *Antilocapra*, considerably larger than in *Odocoileus*, and the small sesamoid-like bone articulating to the inferior surface of the head of the metatarsus is larger and has a more extensive facet than in *Antilocapra*, equalling *Gazella* in this respect.

The vestigial lateral toes are not preserved in the type specimen, but in the cotype the hind foot has associated with it (although not found in position) small rudimentary phalanges, much like those of the fore foot, but somewhat more slender. Except for their much smaller size and somewhat more slender proportions these vestigial toe-bones are much like those in the hind foot of *Odocoileus*.

To sum up the above fore- and hind-limb characters:

*Merycodus* is most nearly related to *Antilocapra*, but in almost all respects more primitive, retaining in greater or less degree characters seen in modern deer, and others which most of the deer have lost.

The lateral toe-bones, entirely absent in *Antilocapra* and the true antelopes, still persist, although much smaller than in the deer. The shaft of the ulna is more reduced than in the deer, but is entirely



separate, while in the pronghorn and antelopes it is still smaller and coössified with the radius. The reduction of the fibula, on the other hand, has gone further than in *Antilocapra* or the true antelopes, at the distal end; and in this respect *Merycodus* is again intermediate between antelopes and deer, although here it is the antelopes that are the more conservative. Most of the minor characters of the limb- and foot-bones relate the animal to the pronghorn and the true antelopes much more nearly than to the deer, but it has not progressed as far in adaptations to speed. The hoofs were small, gazelle-like, and the animal probably stood with the proximal and medial phalanges almost in line with the metapodium, as do the gazelles to-day.

**RIBS AND STERNUM.** — These are very perfectly preserved in the specimen, but call for no extended comment. The ribs are entirely modernized, wide, flat, and thin, especially the anterior ones, resembling most nearly those of *Gazella*, but somewhat wider in proportion, especially anteriorly. The sternum is of the same type as in the antelopes; parts of the cartilaginous ribs were attached when the specimen was found, connecting the sternum with the vertebral ribs, but so imperfectly preserved that it was not practicable to restore them.

### *Merycodus necatus* Leidy.

*Merycodus necatus* LEIDY, Proc. Ac. Nat. Sci. Phila., VII, 1854, p. 90;

Ext. Mam. Faun. Dak. and Neb., 1869, p. 162, pl. xiv, figs. 9, 10.

*Cervus warreni* LEIDY, Ext. Mam. Faun. Dak. and Neb., 1869, p. 172, pl. xxvii, fig. 12.

*Dicrocerus necatus* COPE, Rep. U. S. Geol. Survey W. of 100th Mer., 1877, p. 350, pls. lxxxi, lxxxii.

This is the type species of the genus, and is based on lower jaws, from the Upper Miocene Loup Fork of Bijou Hills and Fort Niobrara, Neb. Professor Cope referred to the same species several specimens from the Loup Fork beds of the Santa Fé valley, of associated jaws and antlers, and distinguished it by the form of the antler, which branches near the base into two equal tines, rather long and curving inward.

Our collections contain several specimens of this type of antler, but none certainly associated with other parts of the skeleton. The teeth are more compressed and hypsodont than in *M. osborni*, the anterior premolars smaller.

### ***Merycodus furcatus* (Leidy).**

*Cosoryx furcatus* LEIDY, Ext. Mam. Faun. Dak. and Neb. 1869, p. 173, pl. xxviii, fig. 8.

*Dicrocerus furcatus* COPE, Rep. U. S. G. S. W. of 100th Mer., 1877, p. 350, pll. lxxx, lxxxi, fig. 1, lxxxii, fig. 1.

*Cosoryx furcatus* SCOTT, Bull. Mus. Comp. Zool., XX, 1890, p. 82, pl. i.

Professor Cope in his descriptions of Vertebrata from the New Mexico Loup Fork, points out the identity of *Cosoryx* with the previously described *Merycodus*, but considers them finally as both identical with *Dicrocerus*. Professor Scott, in his description of the skeleton, follows Cope in the use of *Cosoryx* in place of *Merycodus*. Accepting the specific identifications made by these authors, *M. furcatus* is distinguished by the antler branching high up on the beam into two short, straight, equal tines, and the beam very little flattened at the branching. The teeth are very like those of *M. necatus*.

To this species is pretty certainly referred the fragmentary skeleton from the Republican River Loup Fork, of which the skull has already been described in this paper (p. 110, and figs. 5 and 6). The skeleton bones are very like those of *M. osborni*, but the limbs somewhat smaller. Another fragmentary skeleton, in the Harvard Museum, was described by Professor Scott.

### ***Merycodus? ramosus* Cope.**

*Cosoryx ramosus* COPE, Proc. Acad. Nat. Sci. Phila., 1874.

*Cosoryx furcatus* COPE, in part, of later publications.

Two specimens from the Upper Loup Fork indicate a species intermediate in several respects between *Merycodus* and *Blastomeryx*. It has the long, straight jaw of the former genus, the molars are intermediate between the two in height of crown, and have well-marked basal colonnettes on the external side between the main crescents as in *Blastomeryx*, but no anterior

fold. The premolars are less reduced than in either *M. furcatus* or *M. necatus*.

The type of *M. ramosus* consisted of antlers like those of *M. furcatus*, but larger and three-tined, associated with jaws having the characters just mentioned. Cope appears afterwards to have come to the conclusion that this association was incorrect; if so it is very doubtful whether his name can be used for this species if the rules of nomenclature be strictly applied.

***Merycodus agilis* Douglass.**

*Cosoryx agilis* DOUGLASS, "Neocene Lake Beds of Western Montana,"  
Univ. of Montana, Missoula, Mont., 1899.

In comparing the skull characters of this interesting specimen with those of *M. osborni* and *M. furcatus* described above (p. 111), it was shown that the chief distinctions are quite obviously characters of immaturity. Mr. Douglass has not pointed out, nor do his figures illustrate, any really valid specific characters.

**? *Merycodus teres* Cope.**

***Merycodus trilateralis* Cope.**

These are large species of entirely doubtful position. They are known chiefly from the antlers, but Professor Cope described some fragments of teeth with his *M. trilateralis* type, and these, judging from his description, must have been hypsodont. Except for this the two species might be referred to *Palæomeryx*.

***Blastomeryx* Cope.**

*Blastomeryx* COPE, Rep. U. S. G. S., W. of 100th Mer., IV, part ii, 1877,  
p. 350. Not of later publications.

? *Blastomeryx* SCOTT, Bull. Mus. Comp. Zoöl., 1890, XX, p. 76, figs. 7-9.  
Not of later publications.

This genus was based on a last lower molar; and until recently no better specimens of the type species had been found. Cope afterwards referred to the genus a large brachyodont species which resembles *Palæomeryx*, but differs widely

from the type of *Blastomeryx*. In the 1901 collection from Colorado is a specimen of the type species, *B. gemmifer*, which enables us to characterize the genus more definitely, as follows:

Molars hypsodont, but less so than in *Merycodus*. Anterior cingulum of molars rising into a strong cusp-like ridge externally (absent in *Merycodus*); a well-marked basal cuspule between  $pr^d$  and  $hy^d$  (absent in *Merycodus* except *M. ramosus*). No trace of the "Palæomeryx fold" on lower molars. Premolars smaller and simpler than in *Merycodus*, much smaller and more compressed than in Palæomerycinae. Upper teeth unknown. Limbs and feet approaching those of *Merycodus*, but with various minor differences.

It is doubtful whether the fragmentary skeleton which Professor Scott described as *Blastomeryx* in 1890, should properly be placed under the genus. It was identified by the correspondence of a single upper molar to the lower molar of *B. gemmifer*.

### *Blastomeryx gemmifer* Cope.

*Merycodus gemmifer* COPE, Am. Rep. U. S. G. S. Terrs., 1873 (1874), p. 531.

Type, a third lower molar from Pawnee Buttes, Colorado, No. 8301 Cope, Collection, Amer. Museum. I refer to this species, No. 9449, from the same locality and horizon, consisting of a lower jaw with  $p_2$ - $m_3$ , most of the tibia and pes, the distal part of the humerus and proximal half of the radius.

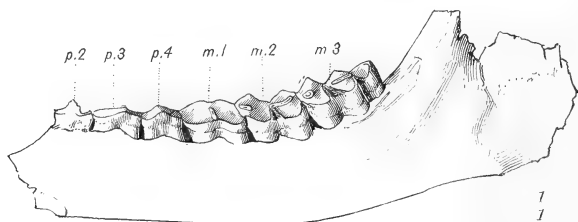


Fig. 17. *Blastomeryx gemmifer*. Lower jaw, external view, natural size. No. 9449. Middle Miocene, Colorado.

It is a little smaller than *Merycodus osborni*, from the same beds, and the proportions of the teeth differ a good deal. The premolars are somewhat smaller,  $m_1$  of about the same size,  $m_2$  and  $m_3$  much smaller as well as shorter-crowned.

Both specimens have the teeth well worn, so that this disproportion is not due to difference in wear. The jaw under  $m_2$ - $m_3$  is not nearly as deep as in *Merycodus*, and the outline of the whole inferior border of the ramus is characteristically different. The tibia is smaller than in *M. osborni*, the groove for the internal flexor tendons (tib. post., flex. long. digit.) is deeper, the fibula is less reduced, its distal end retaining a remnant of the shaft about a centimeter in length, coössified with the tibia in this specimen. The calcaneum is proportionately longer and of more uniform depth than in *M. osborni*; the proximal rudiments of mts. II and V are coössified, but their outlines are clearly defined, the head of mt. V making a rather strong process on the external side of the head of the cannon-bone (not present in *Merycodus*). The shaft of the ulna is coössified with the radial shaft, beginning at about 3 cm. from the proximal end and extending down for not less than 2 cm. This may possibly be pathological, but I hardly think so from its appearance. In *Merycodus osborni* the shaft is entirely separate, even in individuals somewhat older than this *Blastomeryx* appears to be.

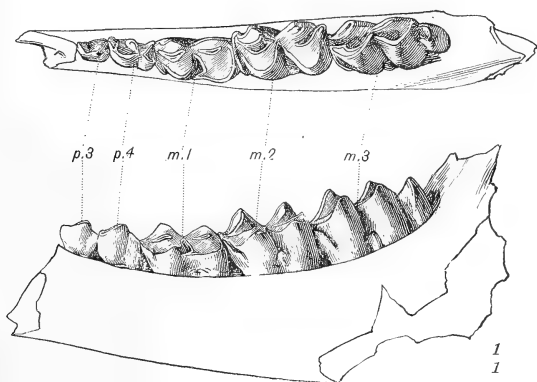


Fig. 18. *Blastomeryx wellsii*. Lower jaw, external view, natural size. Type specimen. Upper Miocene, South Dakota.

### *Blastomeryx wellsii*, sp. nov.

A species of *Blastomeryx* considerably larger than *B. gemmifer* occurs in the Upper Miocene of the Republican River

and Little White River valleys. I take as type a lower jaw, No. 9823, found by Mr. Wells of the American Museum Expedition of 1902, in the Loup Fork Beds near Rosebud Agency, South Dakota. The premolars are relatively smaller and simpler than in the type species; the molars are very similar, and the jaw shorter and heavier in general outline. Two specimens show the milk dentition, which is quite brachydont, the unworn crown of  $dp_4$  hardly any higher than the width of the tooth. In *Merycodus*, on the other hand,  $dp_4$  is

hypsodont, the height of the crown being two or three times the width of the tooth.

Measurements of *B. gemmifer* and *B. wellsii*:

Length of molar series, $m_1$ - $m_3$ .....	26 mm.	38 mm.
“ “ two premolars, $p_3$ - $p_4$ .....	11.5 “	11 “
Anteroposterior diameter of $m_1$ .....	8 “	11 “
Transverse “ “ $m_1$ .....	5 “	6 “
Anteroposterior “ ” $m_3$ .....	11.7 “	16 “

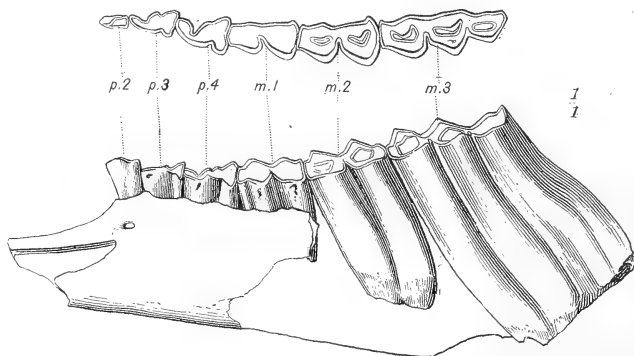


Fig. 20. *Capromeryx furcifer*. Lower jaw, natural size, external view, and crown view of teeth. Type specimen. Pleistocene, Nebraska.

**Capromeryx** *Matthew.*

Bull. Am. Mus. Nat. Hist., 1902, p. 318.

In this genus the teeth are as hypsodont as in *Antilocapra*, but the premolars are of more primitive pattern, approximat-

ing those of *Merycodus* in form. Unfortunately nothing but the lower jaw is known, so that we are unable to say whether it is in any other respects intermediate between the two.

**Capromeryx furcifer** *Matthew*.

Bull. Am. Mus. Nat. Hist., 1902, p. 318.

About the size of *Merycodus osborni*, two thirds the lineal dimensions of *Antilocapra americana*. Pleistocene, Hay Springs, Nebraska.

FAMILY CERVIDÆ.

Sub-family PALÆOMERYCINÆ.

The presence of the "Palæomeryx fold" on the lower molars and the extreme brachydonty of the teeth, are the principal characters by which Dr. Schlosser appears to distinguish this group. I am not sure, however, that I have seen his original descriptions.

**Palæomeryx.**

Douglass has recently described under this genus two large American species, closely allied to the large brachydont forms referred to *Blastomeryx* by Cope and Scott. Professor Scott had stated in regard to the latter that they would probably have to be removed to *Palæomeryx* if the lower jaw were known to possess the characteristic fold of the anterior crescent of the molars, and this is the chief reason given by Mr. Douglass for referring his species to the European genus. As indicated above, this character is common to many or all of the Miocene deer with very brachydont molars; it occurs in *Dicrocerus*, *Dremotherium*, and *Amphitragulus*, as well as in *Palæomeryx*. All the American species that I have seen differ considerably in their dentition from any of the European genera, and appear to possess a different type of antler from any, perhaps a more primitive one. Unfortunately all the known specimens are more or less damaged in this part; all appear to be in the velvet, unbranched, and without burr, but

whether this was a permanent condition it would not be safe to say. The specimens in this museum, though numerous, are mostly fragmentary, and the correlation of parts more or less uncertain. For the present, therefore, it is better to leave this group of brachydont American species under *Palæomeryx*.

***Palæomeryx borealis* Cope.**

The typical specimens are more or less complete skulls and many fragments of the skeleton. The species is about the size of the caribou. The antlers were not branched, and apparently not shed; whether they were covered by velvet or by horn I am unable to determine, but the soft, irregular sur-

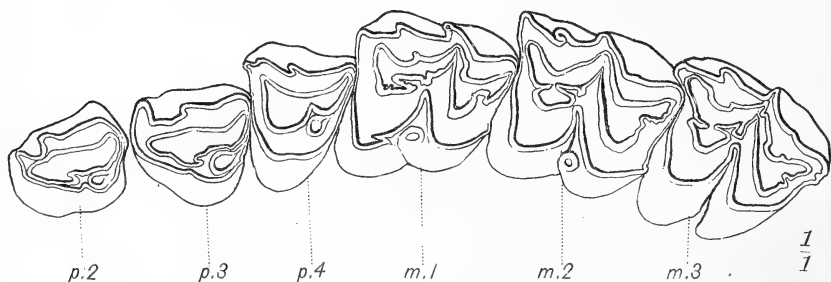


Fig. 21. *Palæomeryx borealis*. Upper teeth, crown view, natural size. Type specimen. Deep River Beds of Montana.

face towards the tip suggests the latter. There was no burr. The basicranial and basifacial axes are parallel, or nearly so. The antlers are supra-orbital, directed forward rather than backward, wide apart at base, and have a peculiar postero-external wing projecting from near the base behind the orbit.

To this species I refer lower jaws associated with several foot-bones from the Colorado Miocene. They show the characteristic "Palæomeryx fold" on the lower molars, and agree in size and proportions with the typical specimens from the Deep River Miocene, among which the lower teeth have not been found. Unfortunately they do not clearly show the most characteristic distinctions in the feet, the presence or absence of lateral toes, and the development of the fibula. The tuber calcis is peculiarly long and of uniform width throughout. The distal end of the radius is deer-like, with a sharp,



clean-cut ridge between scaphoid and lunar facets; in the pronghorn the ridge is round-topped, permitting some lateral movement in the carpus. The scaphoid is smaller than in the deer, but has the same proportion of height to breadth; in the prongbuck it is not nearly so high.

**Palæomeryx, sp.**

A small species of *Palæomeryx* is indicated by teeth and various fragmentary remains in uncertain association from the Colorado Miocene. It is about the size of *Dicrocerus furcatus* specimens from Steinheim; somewhat larger than *Merycodus* or *Blastomeryx*, and easily distinguishable from those genera by the wide, short-crowned molars.



## Article VIII.—NOTES ON TRICHOBIUS AND THE SYSTEMATIC POSITION OF THE STREBLIDÆ.

By CHARLES THOMAS BRUES.

The genus *Trichobius* was erected by Gervais in 1844<sup>1</sup> for the reception of *T. parasiticus* from South America.<sup>2</sup> Since that time two other species have been added: *T. molossus* Gigl.<sup>3</sup> from eastern Asia, and *T. major* Coq.<sup>4</sup> from the southern part of the United States.

The American Museum has recently come into possession of a number of specimens of *T. major* Coq., collected last March by Prof. J. H. Comstock and Mr. Carl Hartmann in a cave at McNeil, near Austin, Texas. All of the specimens were found on bats belonging to the species *Myotis incantus* Allen. As this Dipteran has never been figured, I take this opportunity to present some of the details of its structure and to give a more complete description than that given by Coquillett.

### *Trichobius major* Coq.

Canadian Entomologist, 1899, p. 334.

Head small, scarcely one third as wide as the thorax, rounded in front and much constricted behind, provided above with numerous large bristles, below clothed with more delicate hairs. Eyes very small; each composed of eight ommatidia, a central one and a single circle of seven others. All the ommatidia are distinctly separated and of hemispherical form. The integument surrounding the eyes is white and membranous, while the remainder of the head is darker and much more thickly chitinized. Palpi large, greatly flattened, and hairy, each with a single very large macrochaeta at the tip, projecting far beyond the front margin of the head. Proboscis short, its basal segment of soft consistency and much swollen, the terminal portion sharply pointed and apparently adapted to piercing. Antennæ composed of two joints of nearly equal size; the first slightly cup-shaped and partially enclosing the second on the dorsal side.

<sup>1</sup> Atlas de Zoologie, p. 14.

<sup>2</sup> Later redescribed by C. H. T. Townsend (Ent. News, 1891, p. 106) as *T. dugesii* from Mexico.

<sup>3</sup> Quart. Journ. Micr. Sc., IV, 1864, p. 24.

<sup>4</sup> Canad. Ent., 1899, p. 334.

Thorax nearly circular in outline when seen from above, divided at the middle by a transverse suture which is marked by a sharp black line; the anterior half is also divided laterally by a median longitudinal suture similarly marked. Dorsum shining, finely hairy at the middle, and growing bristly toward the sides. Scutellum rhomboidal, bare, except for a transverse row of eight long, backwardly directed macrochætæ.

Abdomen considerably longer and narrower than the thorax, distinctly angulated at the sides near the base, the angulation provided with a dense brush of reddish bristles; at the tip with finer and less distinct bristles, these latter, however, quite conspicuous in the male.

Legs very stout; the femora considerably swollen, hairy, especially above where the hairs are very long. Tibiæ gradually dilated toward the apex. Tarsi with the four basal joints of nearly equal length, together hardly longer than the large fifth joint; claws sharp, with a large lobe at the base; empodia large, fleshy.

Wings oval, slightly longer than the body, tinged with brown, the veins yellowish brown. Costal vein extending as far as the tip of the third vein, the cilia at its base very weak. All the wing veins of nearly equal strength, beset with fine bristles.

In all of the specimens which I have seen (some 25), the color is deep reddish yellow everywhere, except on the discal portion of the abdomen, where it is light grayish yellow.

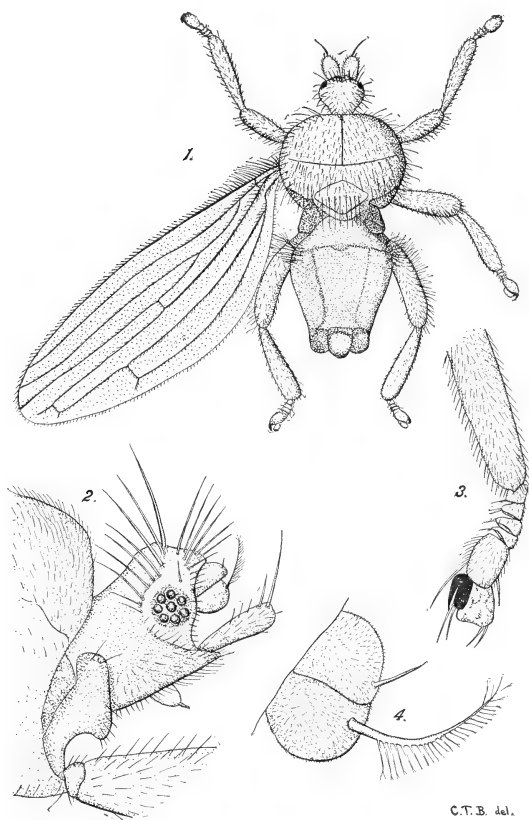
The males and females are very similar in size and form, and can be distinguished only by the contour of the external genital organs. Some sections through the abdomen of a male specimen show large bodies of irregular polyhedral shape which fill out almost the entire cavity. These seem to consist of a gelatinous, yolk-like substance, and at first sight might easily be mistaken for maturing eggs. The testes are, however, plainly visible, extending along each side of the median line in the anterior portion of the abdomen.

The three families, Nycteribiidæ, Streblidæ, and Hippoboscidæ, have always been considered as more or less closely related forms, and the three are usually separated and regarded as quite distinct from other Diptera.

Recently Speiser<sup>1</sup> has summarized the more important characters of the Streblidæ, which serve to distinguish them from the Hippoboscidæ on the one hand and from the Nycteribiidæ on the other. Briefly stated they differ from the former

<sup>1</sup> Archiv f. Naturg., Band L (1900), p. 33.

by the relatively large and freely movable head; the small size and degenerate structure of the eyes, or even their complete absence in some forms; by the large, dorso-ventrally



C.T.B. del.

Fig. 1.—*Trichobius major* Coq. Female, dorsal view, with the right wing and left middle leg removed; 2, Head of same, in profile; 3, Terminal portion of leg; 4, Antenna, lateral view, more highly magnified.

flattened palpi, which do not form a sheath for the proboscis as in the Hippoboscidae; and by the wholly different wing venation. Differences from the Nycteribiidae are not so evident. They rest principally on the different form of the head, thorax, and legs.

An examination of the wings of *Trichobius* reveals the fact

that they are of a very generalized type, since the veins are distributed evenly throughout the entire extent of the wing. There are six longitudinal veins, all nearly parallel; and three cross-veins, anterior, posterior, and anal, the latter much further from the base of the wing than in other Muscidae. This is in sharp contrast to the Hippoboscid wing, in which the veins are all shifted forward toward the anterior margin, leaving their whole posterior portion devoid of venation. From this it is plainly evident that the Streblid wing cannot be derived from one of the specialized Hippoboscid type. With regard to the condition of the eyes in the two groups, exactly the reverse is true. The Hippoboscidae still retain these organs in a comparatively large and complex form.

If derived from a common stem, therefore, the two groups must have been separate since the time when both possessed generalized wings and eyes, the Hippoboscidae later developing their characteristic wing venation, and the Streblidae undergoing a degeneration in the structure of the eyes. Of these changes the alteration of the venation is by far the more profound. Such a form must have been quite different from either of the two modern groups.

The different habits of the two can hardly be urged as a distinction of importance, since the Hippoboscidae are known to be parasitic on both birds and mammals, showing a greater diversity among themselves, than from the Streblidae, which are confined almost exclusively to bats.

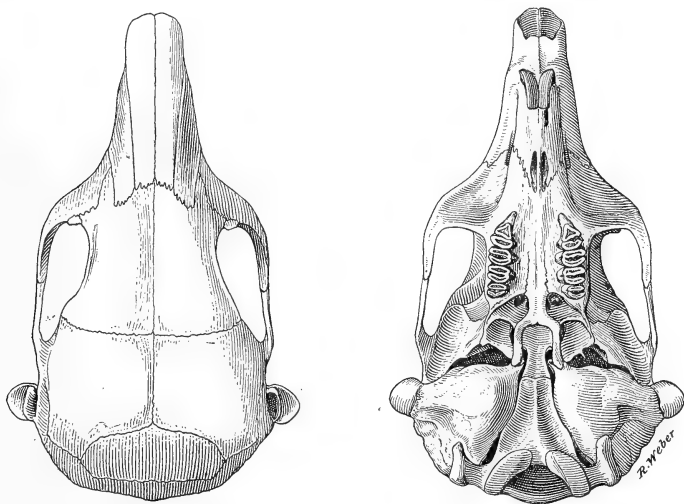
It seems on the whole, however, that we have to deal with a most anomalous group, which is certainly quite different from the Hippoboscidae and more generalized.

**Article IX. — THE EXTERNAL EAR BONE IN CERTAIN RODENTS.**

By J. A. ALLEN.

My attention was recently called by my assistant, Mr. F. A. Schneider, to a skull of *Liomys canus* Merriam which showed a singular bony appendage attached by a ligamentous hinge to the front lower border of the left meatus auditorius, it having attracted his notice, in cleaning the skull, as something out of the ordinary. As he had several other skulls of this species to prepare, I urged him to take great care to save this appendage in situ. As a result he found it on one or both sides of several of the remaining skulls, including the one here figured.

This external ear bone is situated at the front lower border of the meatus and is hinged to it by ligament; it has the



Skull of *Liomys canus* Merriam, showing external ear bones. No. 20995, Am. Mus. Nat. Hist., ♂ ad. Twice nat. size.

form of a truncated oval or crescentic appendage, quite large and prominent, as shown in the accompanying figures. Although hinged and moveable, the range of movement is from

the vertical forward; it cannot be pressed backward to close the meatus without breaking the ligamentous hinge, but can readily be flexed forward through a wide angle. Its function therefore seems to be to prevent the closing or partial closing of the meatus by the soft parts of the ear. The external ear is not large, in this group, for the size of the animal, as is the case in *Chinchilla*, where it also exists, so that this appendage is not necessarily correlated with a large external ear, nor even with greatly developed audital bullæ. This bone is of very dense structure, and is evidently developed from an independent center of ossification.

On examination of alcoholic specimens of *Liomys bulleri* (Thomas), *Heteromys anomalus* (Thompson), and *Heteromys jesupi* Allen, I find this appendage to be well developed in each of these species, as it doubtless is in all the members of the *Heteromys* (including *Liomys*) group. But I could find no trace of it in the only species of *Perognathus* of which alcoholics are available for examination. In the larger species of *Perognathus*, as in the *hispidus* and *penicillatus* groups, there seems to be a functional equivalent in the building up of the anterior border of the bony meatus into a slightly projecting lip. I have found it also absent in *Zapus* and *Proechimys*, where it seemed likely to occur; but in the case of the latter the base of the external ear forms a firm cartilaginous tube. A glance at the skull of a *Dipodomys* or a *Perodipus* is sufficient to show that no equivalent modification need be looked for in these groups, owing to the posterior position and backward opening of the meatus. Anatomical examination of these forms has confirmed this assumption.

This structure does not appear to be mentioned in general works on mammalian anatomy, but there are incidental references to it in other connections — just how many is difficult to trace. I have thus far found only the following:

In 1890 the late Dr. G. E. Manigault, of Charleston, South Carolina, reported (Proc. Elliott Soc. Nat. Hist., May, 1890, pp. 237-239) the discovery of a "crescent-shaped flat bone occupying the anterior half of the outer edge of the external meatus of the ear," in *Chinchilla lanigera*, and gave figures



of it. He being unable to find any published account of such a structure, either in the Chinchilla or other mammals, wrote to various leading mammalogists and comparative anatomists on the subject but succeeded in obtaining no very definite information. Mr. G. B. Howes of London, in reply to his inquiries, stated that he was familiar with it, and "with its like in other Hystricomorpha. There are two such in *Cavia*, and I believe them to be ossifications of the cartilaginous meatus externus." Mr. Howes further stated that he knew of no published description of this bone. Mr. Oldfield Thomas, in replying also to Dr. Manigault's inquiries, said: "Like him (Mr. Howes) I have seen the extra ear bone myself, but cannot remember where there is a description of it. I have, however, a strong impression that I have seen it described somewhere, but by whom, and in what particular animal I cannot recall."

I had likewise searched carefully for some published account of this interesting feature, but had been able to find only that given by Dr. Manigault, as cited above, until my attention was called by Prof. W. B. Scott, the eminent palæontologist, to a paper by Dr. W. Peters on the genus *Pectinator*, wherein it is mentioned.

Dr. Peters, in describing the skull of *Pectinator* (Trans. Zoöl. Soc. London, VII, Pt. V, 1871, p. 401) states: "The tympanic bullæ are also comparatively larger than in *Ctenodactylus*; but the meatus auditorius externus has the same direction, and is in the same manner elongated by an inferior semiannular osseus appendage, as in *Ctenodactylus*."

Dr. Peters's figure of this appendage (*l. c.*, pl. 49, fig. 3) shows that it closely resembles, in size and form, the same structure in *Heteromys*.

Mr. Wm. Yarrell, many years before, gave an account of the anatomy of *Ctenodactylus massonii* Gray (P. Z. S., 1831, p. 44), in which he says: "The *meatus auditorius* is elongated, forming a tube 2-10ths of an inch in length on the inferior surface and lined with a dense pigment." But he says nothing of this elongation being produced by the development of a separate ossicle

Doubtless other cases are on record, but those above cited indicate that this structure occurs in several widely separated groups of Rodents.

In species in which this structure exists, it is not likely to be met with attached to the skull in Museum specimens, since, owing to its nature and position, it would naturally be removed or mutilated by the collector in taking off the skin, attached to which it may doubtless be occasionally detected by careful examination.

## Article X. — THE AMERICAN ANTS OF THE SUBGENUS COLOBOPSIS.

By WILLIAM MORTON WHEELER.

### I. HISTORICAL NOTES ON THE TAXONOMY AND HABITS OF COLOBOPSIS.

*Colobopsis* was established by Mayr in 1861 as a genus for the reception of the European *Formica truncata* Spinola.<sup>1</sup> At the same time Mayr described the worker of *C. truncata*, of which Spinola had seen only the soldier, as a separate species under the name *C. fuscipes*. It was reserved for Emery to discover that *C. truncata* and *C. fuscipes* are really the soldier and worker phases respectively of the same species.<sup>2</sup> Twenty years later the same author showed that *Colobopsis* must be reduced to a subgenus under *Camponotus*, owing to the existence of forms intermediate between these two groups and the relatively unimportant distinguishing characters of *Colobopsis*.<sup>3</sup> Since 1889 *Colobopsis* has been used to include those species of *Camponotus* which have sharply truncated heads in the soldier caste. A number of species, especially from southern Asia, Polynesia, and Australia have from time to time been assigned to the group.

In his admirable systematic catalogue of the genera *Camponotus*, *Polyrhachis*, and their allies,<sup>4</sup> Emery defines the subgenus *Colobopsis* more concisely (p. 764). "I deem it advisable," he says, "to confine the maniple No. 14, representing the subgenus *Colobopsis*, exclusively to those species in which the anterior truncated surface of the head in the major workers and the females is distinctly marginate and in which even the mandibles have a sharp external ridge separating an anterior from a latero-ventral face. In these species the head presents a peculiar sculpture consisting of umbilicate punc-

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<sup>1</sup> Die Europäischen Formiciden. Wien, Carl Gerold's Sohn., 1861, p. 38.

<sup>2</sup> Enumerazione dei Formicidi che rinvenngonsi nei contorni di Napoli, etc. Ann. Accad. Asp. Nat. Napoli (2), II, 1869, p. 5, No. 6.

<sup>3</sup> Ann. Mus. Civ. Genova, XLVII, 1889, p. 517.

<sup>4</sup> Saggio di un Catalogo Sistematico dei Generi *Camponotus*, *Polyrhachis* e Affini. Mem. R. Accad. delle Sci. Ist. di Bologna. Sess. 8, Marzo, 1896, pp. 761-780.

tures. The type of the group is *C. truncatus* of southern Europe. It is customary to ascribe to the subgenus *Colobopsis*—in my opinion, incorrectly—many other species, which I have assigned to my maniples 7, 9, 10, and 13. I maintain that the subcylindrical and truncated form of the head is an extreme adaptation to living in wood, and must have arisen by convergence in diverse groups which are phylogenetically independent of each other.”

We may accept Emery's strictures with the addition of two negative characters that seem to separate the species of *Colobopsis* from *Camponotus* proper, namely, the rarity or total absence of intermediates (*mediæ*) connecting the soldier (major) and worker (minor) castes, and the absence of a cocoon in the pupal stages of all the phases. As thus restricted, and apart from a few imperfectly known and therefore dubious species from Australia and Java, the subgenus *Colobopsis* is known to include only the following: *truncatus* Spin. (Europe); *rothneyi* Forel (India); *impressus* Roger (southern United States); *riehlii* Roger (Cuba); and *abditus* Forel (Guatemala). In the present paper I add two new forms from Texas, a new species allied to *impressus* and a new variety of *abditus*. The latter may prove to be really a new species when all the phases of the true *abditus*, originally described from a single female specimen, have been brought to light. Roger's description of *riehlii* is also based on a single female specimen.

For our knowledge of the peculiar habits of *Colobopsis* we are indebted to Forel, who has repeatedly studied *C. truncatus* in Switzerland.<sup>1</sup> I quote the following account from his paper on 'Ants' Nests' and reproduce the two figures to which he refers:

“The best wood-cutters are those species of the genus *Camponotus* Mayr, which have a short, broad head, rounded off in front, especially the subgenus *Colobopsis* Mayr.

“These ants frequently bore with their short powerful jaws

<sup>1</sup> Les Fourmis de la Suisse: 1874, p. 43, 386-388; Ants' Nests. Smith. Report, 1894 pp. 486, 487; pl. iv., Figs. 11, 13, and 19; Faune Myrmécologique des Noyers dans le Canton de Vaud. Bull. Soc. Vaud. Sc. Nat. 4 ser., Vol. XXXIX, No. 146. Lausanne, 1903, pp. 83-94.

into the very hardest wood, and construct secure and elegant labyrinths for themselves in it. This is the case with *Camponotus pubescens* in Wallis and Tessin, and *Camponotus marginatus*. The latter bores into the softer layers of the wood when they are somewhat decayed and lets the harder part remain, so that its nests are more concentric around the center of the bough or trunk in their arrangement. I have noticed them in cherry trees and Paulownias.

"The smaller and very timid species of *Colobopsis* build themselves nests in the hardest wood. These nests open outward by only a very few small apertures, which are concealed by the irregularities of the bark of the tree. These apertures are kept closed by the head of a 'soldier' sentinel who permits only friends to enter. The soldier's head is broadened and rounded off in front, evidently for this very use. The rounded surface is rough, of a dull brown color; the feelers are planted back of the rounded surface, so that the latter present no hold and block up the entrance to the nest like a living stopper. I first observed this fact among our *Colobopsis truncata* Spin. at Vaux, Canton Vaux (Fig. 13, drawn four-thirds of the natural size), but the similar structure of the head and the habit of living in trees, which characterize the other species of *Colobopsis*, lead us to infer that they live in the same way.

"Fig. 13 [Fig. 1] represents a portion of the original piece of a nest of *Colobopsis truncata* discovered by me in a very hard, dead bough of a pear tree. *B* is the bark of the pear tree; *Ch* is the chambers and passages of the nest; *O* is the exterior opening of the nest; behind it, on the gallery of egress of the nest, stands a *Colobopsis* 'soldier' as a sentinel, keeping the door closed with his head. At *W* are seen two *Colobopsis* workers, one hastening toward the door from the outside, the other standing in the nest. The soldier will go back into the nest for a moment in order to let the first worker come in (I have noticed this among the living ants). That the part played by the *Colobopsis* 'soldier' is that of a living stopper is further proved by the fact that there are comparatively few of them, and that in contrast to the workers they hardly

ever go out. Fig. 19 [Fig. 2] represents a 'soldier,' still more magnified, standing at the door of egress.

"Those species of *Camponotus* which live in a similar way, such as *Camponotus marginatus* Latr., display the beginning of a similar rounded surface on the front part of the head, and always have a large-headed sentry at the door."

Recently Forel has published several interesting ethological observations on *C. truncatus* in his study of the ant-fauna

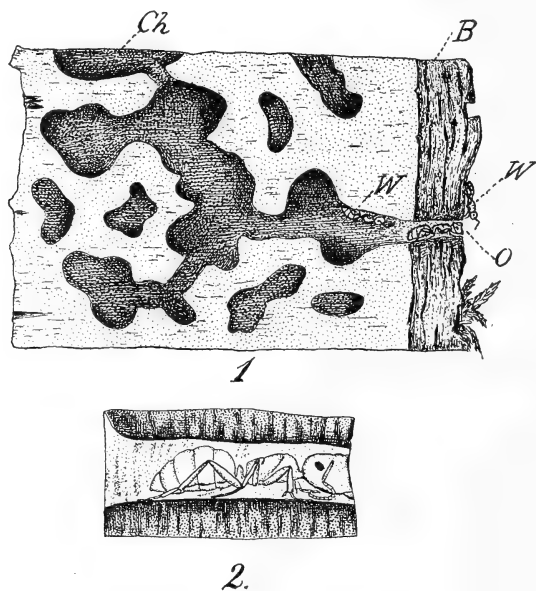


Fig. 1. Section of nest of *Camponotus (Colobopsis) truncatus* Spin. in wood. See explanation in the text. (After Forel.)

Fig. 2. Soldier of *C. truncatus* occluding the nest entrance with its head. (After Forel.)

of the nut-trees. In addition to *truncatus*, this fauna comprises *Dolichoderus 4-punctatus* L., *Leptothorax affinis* Mayr, and *Camponotus marginatus* Latr. He has repeatedly called attention to the close resemblances in form and color between the workers of *D. 4-punctatus* and *C. truncatus*. This resemblance is regarded as a case of mimicry. When both species have their nests in the same tree, there seems to be a mutual toleration which Forel interprets as a tendency toward para-

biosis. He finds, moreover, that a single colony of *truncatus* may occupy several different nests in the same tree. It is polydomous, to use Forel's expression. The gist of his observations is contained in the following passage:

"Having blown the whole contents of 12 *Colobopsis truncata* nests into a glass tube, I found it to comprise 400 workers, 77 soldiers, 2 females (one winged and one isolated), 5 males (from 2 nests).

"These numbers seem to prove two things: First, that the proportion of soldiers is about one to five or six workers; second, that the formicaries are polydomous as in *Dolichoderus 4-punctatus*, since none of the nests contained a fertile female. The only fertile female detected was isolated (*i. e.*, founding a colony in one of the branches).

"The average population of each nest (40 ants) thus gives no measure of that of a colony, which in the same nut-tree probably comprises in the mean from 10 to 20 nests.

"This fact recalls the polydomous formicaries of the tropical American *Dolichoderus bidens*, each nest of which is constructed of paper beneath a green leaf and forms a large chamber.

"Every nut-tree therefore comprises a formicary of *C. truncatus*, living in incomplete parabiosis with a colony of *Dolichoderus 4-punctatus* (it would be complete if the two species were to inhabit the same hollow limbs), whereas the *Leptothorax affinis* forms monodomous formicaries, the inhabitants of which are hostile to one another and to the two other species. . . ."

"We see therefore that *Colobopsis truncata* profits by the use of preëxisting cavities, the entrances to which are undoubtedly guarded by soldiers, as in the case of the nests excavated by the same species. But this species is also able to excavate in hard wood. Moreover, as other authors have shown, it also utilizes the cavities of galls.

"In exploring myrmecological faunas in future, it would be advisable to examine twigs and dry branches. They have many surprises in store for us."

As I shall show in the sequel, the hitherto undescribed

habits of our American species of *Colobopsis* agree very closely with Forel's account of the European form. I have had frequent opportunity to study the habits of one of the new forms from Texas (*C. abditus* var. *etiolatus*), and have seen enough of the nesting habits of the other to affirm that these too agree very closely with Forel's description of *C. truncatus*.

## II. DESCRIPTIONS OF AMERICAN SPECIES OF COLOBOPSIS.

### 1. *Camponotus (Colobopsis) impressus* Roger.

*Colobopsis impressa* ROGER, Berl. Ent. Zeitg., 1863, p. 160 ♂.

*Colobopsis impressa* MAYR, Verh. zool. bot. Ges. Wien, 1886, pp. 423, 424. 2 ♀.

*Camponotus (Colobopsis) impressus* EMERY, Ann. Mus. Civ. Genova, XXVII, 1889, p. 517.

*Camponotus (Colobopsis) impressus* EMERY, Zool. Jahrb. Abth. f. Syst., VII, 1893, p. 681 ♂.

*Soldier.* (Fig. 3, *a*, *b*, and *c*.) Length, 4.3-4.6 mm.

Head subcylindrical, from above rectangular, but little longer than broad, sides parallel, occipital border convex, anterior truncated surface concave, its edge distinctly carinate along the sides, but rounded above in the clypeal and adjacent regions. Mandibles small, with flattened lower surfaces, 4-toothed, with a short toothless proximal portion to the blade. Clypeus on the truncated surface twice as long as broad, slightly broader above, extending onto the dorsal surface of the head as a transversely oblong piece about three times as broad as long. There is a distinct median keel running the full length of the clypeus. Frontal carinae far apart, distinctly converging in front, somewhat convex externally. Eyes moderate, flattened, their anterior orbits about a third the distance from the posterior border of the head to the tips of the mandibles. Antennal scapes curved, slender at the base, gradually enlarging towards their tips, which extend beyond the posterior corners of the head to a distance about equal to their transverse diameter. All the funicular joints except the first, subequal, a little longer than broad, first joint nearly as long as the second and third together. Thorax robust, pronotum broader than long, very convex and rounded, and forming a sphere with the mesonotum. Mesopinotal constriction broad and pronounced. Epinotum with short convex basal, and longer, somewhat concave declivous surfaces, the angle between the two being rather blunt. Petiole low, convex and rounded in front and above, flattened behind, the posterior dorsal edge of the node being distinctly impressed in the middle, but not excised



or emarginate. Gaster rather broad, flattened dorso-ventrally. Legs short, femora compressed, anterior pair distinctly dilated.

Mandibles opaque, finely punctate, longitudinally and obscurely rugose. Anterior two-fifths of head subopaque, coarsely and rather regularly reticulate-rugose, the spaces enclosed by the rugæ being densely punctate. On the front and cheeks the sculpture passes over into shallow umbilicately punctate foveolæ. Behind this region there is a narrow uniformly punctate zone both on the cheeks and front. Posterior portion of head and remainder of body shining, delicately but distinctly shagreened.

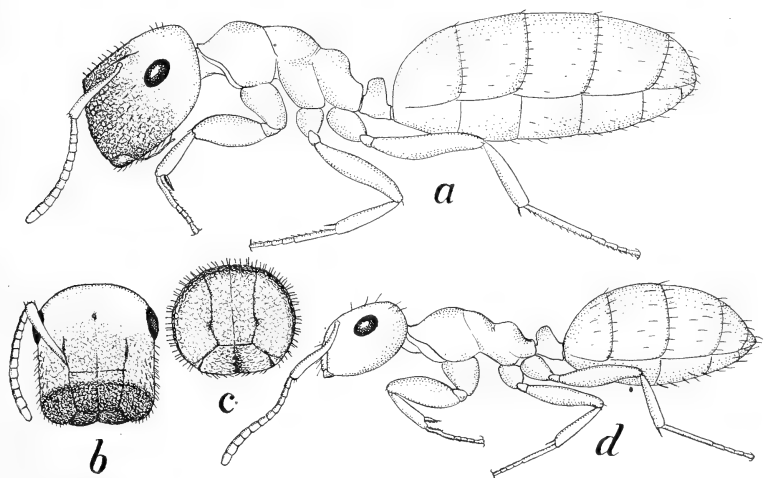


Fig. 3. *Camponotus (Colobopsis) impressus* Roger. a, Soldier; b, head of same from above; c, head of same from the front; d, worker.

Cheeks and anterior dorsal surface of head with short, erect, obtuse, brown hairs. There are a few erect hairs on the vertex and on the gastric segments, especially along their posterior edges, and a few at the tips of the antennal scapes and femora. The legs are sparsely covered with minute, appressed white hairs.

Thorax and appendages dark brown, the former with yellowish sutures, gaster and posterior two-thirds of head black; anterior third of head light yellowish brown. Mandibular teeth black.

*Worker.* (Fig. 3, d.) Length, 3.5-4.5 mm.

Head but little longer than broad, a little broader behind than in front, cheeks convex. Mandibles small, 4- to 5-toothed, when closed their external margins form a straight line at right angles to the long axis of the head. Clypeus nearly square, obscurely keeled. Frontal carinæ converging in front. Antennæ more slender and pro-

[April, 1904.]

portionally longer than in the soldier, surpassing the posterior corners of the head by about one third their length. Thorax and petiole resembling the corresponding parts of the soldier. Gaster proportionally smaller and more pointed.

Body and appendages shining, distinctly shagreened, the head and thorax more coarsely than the gaster; the cheeks and upper surface of the head also with scattered punctures.

Cheeks and legs covered with delicate, appressed, white hairs. Clypeus, front, vertex, tips of antennæ and femora and the gastric segments with a few scattered and longer brown hairs.

Dark brown, head and gaster black, mandibles yellow, anterior portions of cheeks and clypeus, antennæ and legs, pale brown.

*Female.* Length, 6 mm.

Head like that of the soldier but less robust. Petiole as in the soldier, with a low, thick, four-cornered node, which is broader than high.

Sculpture and pilosity as in the soldier.

Ferruginous, in part yellowish red. Mesonotum, except for two yellow longitudinal lines, the scutellum and the middle of the epinotum, light brown; gaster brownish black, the anterior two-thirds of the first and second segments yellow.

*Male.* According to Emery "very similar to the South European *C. truncatus* Spin. in form and coloration, but somewhat smaller (4-4.5 mm.); in other respects hardly distinguishable."

Type locality: "United States of America."

Specific localities: Savannahs of Georgia and Florida (Mayr); Texas and Florida (Emery). The soldiers and workers from which the above descriptions were taken, came from Lake Worth, Florida (Rev. P. J. Schmitt, O.S.B.)

## 2. *Camponotus (Colobopsis) riehlII* Roger.

*Colobopsis riehlII* ROGER, Berl. Ent. Zeitg., VII, 1863, p. 159, No. 40 ♀.

*Camponotus (Colobopsis) riehlII* EMERY, Ann. Mus. Civ., Genova, XXVII, 1889, p. 517.

*Female.* Length, 6.5 mm. Pale reddish brown, shining. Thorax paler than the head; gaster dark brown, head and gaster sparsely (thorax apparently not at all) provided with short, erect hairs. Head throughout as in *truncata*. The sculpture is not so irregular as in this species, but consists of large, foveolate, shallow, somewhat shining punctures, each of which has a small puncture in its center; similar punctures are seen in *truncata* on the sides of the head. The frontal carinæ are almost parallel, in *truncata* they converge distinctly in front. There are three large ocelli. In front and behind the thorax is delicately striolate-reticulate, but very sparsely punctulate on the mesono-

tal disc. Petiole rounded above. Gaster transversely rugulose. Wings hyaline, somewhat iridescent, with pale yellow veins and stigma. The neuration is exactly as in *Camponotus*.

"This species is very similar to *truncata*, but the more regular sculpture of the head, the finely punctulate thorax, the non-emarginate petiole and the parallel frontal carinae are sufficiently distinctive characters.

"Cuba." (Roger.)

### 3. *Camponotus (Colobopsis) pylartes* sp. nov.

*Soldier.* (Fig. 4, *a*, *b*, and *c*.) Length, 4.5–5 mm.

Head subcylindrical, somewhat longer than broad, decidedly wider in front than behind, with inflated cheeks; occipital border straight or slightly concave. Anterior truncated surface oblique, in profile distinctly concave, with a sharp border only on the sides of the face and mandibles; on the clypeal and adjacent regions the truncated passes into the dorsal surface through a rounder angle than in *impressus*. Mandibles larger than those of *impressus*, with more convex ventral margins; blade with four distinct apical teeth and a toothless basal portion. Eyes, clypeus, frontal carinae and antennae as in *impressus*. Thorax distinctly narrower and less robust, the pronotum being fully as long as broad and forming an ellipsoid with the mesonotum when seen from above; dorso-ventral diameter of the pro- and mesonotum much shorter than in *impressus*. The mesoepinotal constriction is shallower, though pronounced, the angle formed by the basal and declivous surfaces of the epinotum is more acute, and the former surface is longer and flatter. Petiole low, robust, as broad above as below, its anterior and posterior surfaces straight and parallel, the former passing over roundly into the flat top of the node when seen in profile; from above the node is convex in front and flattened behind. From behind it is somewhat more distinctly impressed in the middle above than in *impressus*. Gaster and legs as in that species.

Mandibles and anterior third of head subopaque, the former obscurely longitudinally rugose-punctate, the latter regularly and coarsely reticulate-rugose, with punctate interrugal spaces. Posteriorly this sculpture passes gradually into shallow and more scattered, umbilicately punctate foveolae on the front and cheeks. Posterior half of head and remainder of body shining, finely shagreened.

Hairs yellowish, short, erect and obtuse on the anterior half of the head, except its truncated surface, longer and tapering on the front and vertex. Gaster with scattered tapering hairs which are most abundant on the terminal segments. There are a few hairs at the tips of the antennal scapes and femora, and minute, appressed white hairs on the femora and tibiae.

Thorax and appendages yellowish brown; posterior two-thirds of

head dark brown, gaster black, with the basal fourth of the first and second and sometimes of the third segment, yellow. Femora, tibiae and upper surface of the thorax sometimes darker than the lower portions of the thorax. Mandibular teeth black.

*Worker*. (Fig. 4, d.) Length 3-4 mm.

Mandibles when closed more projecting than in *impressus*. Clypeus and anterior portion of head less convex. Antennal scape surpassing the posterior angle of the head by nearly half its length. Thorax resembling that of the soldier, low through the pro- and mesonotum, which are also narrower than in the worker *impressus*. Basal epinotal

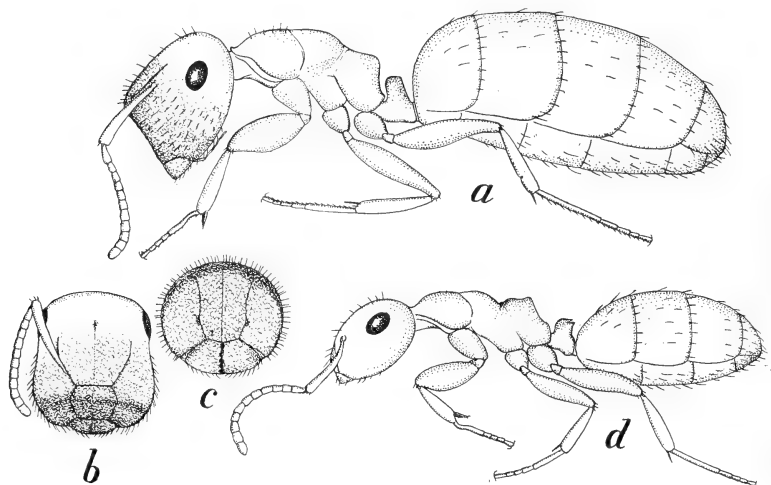


Fig. 4. *Camponotus (Colobopsis) pylartes* sp. nov. a, Soldier; b, head of same from above; c, head of same from the front; d, worker.

surface long and flattened, the declivity shorter and concave, the two surfaces meeting at a right angle. Petiole and legs as in the soldier. Gaster proportionally shorter and more pointed.

Shining throughout and finely shagreened, the front and cheeks also faintly and sparsely punctate, the sculpture throughout being somewhat fainter than in the worker *impressus*.

Hairs white, sparse; long and erect on the clypeus, front and gaster, minute and appressed on the cheeks and legs.

Yellowish brown; head, gaster, apical third of funiculus, femora and tibiae, dark brown or black; base of first and second gastric segments, mandibles, anterior portions of cheeks and clypeus, yellow.

*Female*. Length 5.5 mm.

Head resembling that of the soldier, but somewhat more slender, with ocelli, slightly larger eyes and less inflated cheeks. Thorax

hardly two and one half times as long as broad, mesonotum about as broad as long. There is a close resemblance to the soldier in the sculpture and pilosity. Anterior half of head brownish yellow with dark brown clypeal sutures and external mandibular borders. Teeth of mandibles black. Posterior half of head dark brown. Thorax and petiole yellow, pro- and mesonotum, scutellum and pleuræ clouded with pale brown. Gaster black, basal and dorsal half of first and second segments, basal fourth of third segment and entire ventral portions of first and second segments, pale yellow. Coxæ yellow, remainder of legs and antennæ brown. Wings whitish hyaline, with pale yellow veins and stigma.

Described from seven soldiers, numerous workers and a single female taken June 26 from a nest in a dead hickory branch (*Hicorea myristicæformis*) at Delvalle, near Austin, Texas. I have also taken single workers running on the leaves and twigs of walnut trees near Austin and at New Braunfels, Texas. Among the specimens captured at Delvalle are two individuals that are clearly intermediate in structure of head and size of body between the soldier and worker; in other words, they are true mediæ.

Although closely related to *C. impressus*, *C. pylartes* is very distinct in the shape of the thorax in the soldier and worker, and in the coloration of the gaster which is not banded with yellow in these phases of the latter species.

#### 4. *Camponotus (Colobopsis) abditus* Forel.

Biol. Centrali-Am., Hymenoptera, Vol. III, p. 158, No. 58. ♀.

"*Female*. Length, 7.5 mm. The truncation of the face is much more concave than in *C. truncatus*, and bordered by a distinct ridge, as in *C. rothneyi*; but the portion of the clypeus situated behind the truncated surface is short, as in *C. truncatus*. The truncated surface forms rather accurately a semicircle, the diameter of which is in front. Borders of the clypeus feebly diverging behind. Frontal carinæ very far apart, slightly sinuous. Head behind the truncation in the form of a short rectangle, a little broader in front than behind, much shorter than in *C. truncatus* and *C. rothneyi*, a little longer than broad. Eyes large, placed a little in front of the posterior third. Scapes hardly incrassated at the tip, rather slender, extending a little beyond the occiput. Joints of funiculus altogether cylindrical, not separated by constrictions. Thorax and petiole as in *C. truncatus*. Body narrow, elongated. Legs rather short; femora compressed.

"Truncated surface of the head finely and rather irregularly reticulate, subopaque; the portion of the head immediately behind this region is finely and densely reticulate-punctate, rather opaque, with large and very abundant, scattered punctures. Occiput, vertex, and the remainder of the body shining, feebly shagreened. Pilosity and pubescence very sparse. Tibiæ and tarsi without erect hairs.

"Pale reddish yellow; legs and antennæ yellow. Middle portions of the gastric segments largely clouded with brownish. Wings subhyaline; veins and stigma pale yellow.

"Hab. Guatemala, Capetillo (Champion). Allied to *C. impressus*, but the border of the truncation is more acute and the sculpturing less pronounced" (Forel).

Var. *etiolatus* var. nov.

*Soldier*. (Fig. 5, *a*, *b*, and *c*.) Length, 5-6 mm.

Head subcylindrical, from above suboblong, about one and one half times as long as broad, a little broader in front than behind; sides and occipital border straight; anterior truncated surface circular, concave, marked off on all sides from the remainder of the head by a sharp ridge. The clypeal portion of this surface is a little broader above than below, its borders somewhat concave on either side below the middle; it extends beyond the ridge onto the upper surface of the head for a much shorter distance than in *C. impressus* and *pylartes*. Frontal carinæ far apart, distinctly converging in front. Eyes large, their anterior orbits two fifths the distance from the occiput to the truncated surface. Antennal scapes curved, slender at the base, incrassated towards the tip, which extends to a distance somewhat greater than its transverse diameter beyond the posterior angle of the head. First funicular but little longer than the succeeding joints. Mandibles much larger and more projecting than in *impressus*, with convex ventral borders, four apical teeth, and a straight, toothless basal border. Thorax in profile evenly and gently arcuate above, with very faint promesonotal and mesoëpinotal incisures. Pronotum rounded, hardly broader than long; mesonotum as long as broad, somewhat narrower behind than in front. Epinotum much compressed laterally, with a pronounced angle between its basal and declivous surfaces, the latter only slightly concave and of about the same length as the former. Petiole low and thick, convex in front and above, flattened behind, its upper posterior margin entire and not transversely indented as in *impressus* and *pylartes*. Gaster elongate, suboblong, depressed. Legs rather short, femora flattened, anterior pair considerably dilated.

Mandibles and anterior two-fifths of head subopaque, the former irregularly rugose-punctate, the latter more coarsely and reticulately rugose, with densely punctate interrugal spaces. On the cheeks and

front the sculpture gradually passes over into umbilicately punctate, shallow and scattered foveolæ. Posterior half of the head and remainder of the body shining, minutely shagreened.

Hairs yellow; short, clavate, and erect on the anterior half of the head, except its truncated surface; longer and tapering on the front. On the gastric segments there are a few scattered hairs, more abundant on the terminal segments. The tips of the antennal scapes and femora are furnished with a few hairs, and there are some very inconspicuous hairs on the legs.

Pale yellow. Mandibular teeth black. Anterior half of the head

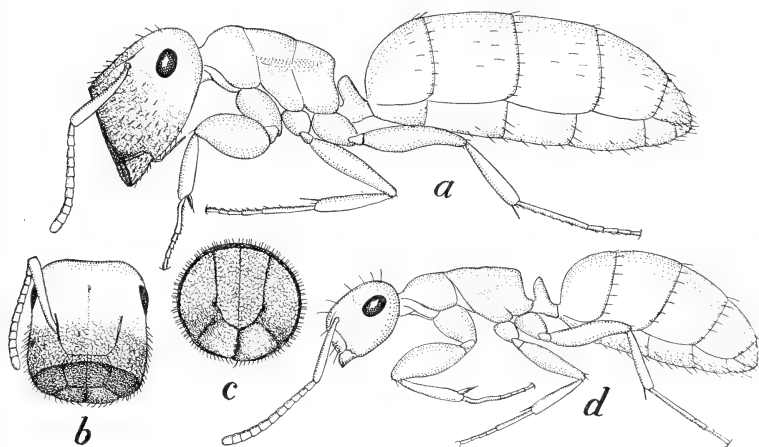


Fig. 5. *Camponotus (Colobopsis) abditus* Forel var. *etiolatus* var. nov. a, Soldier; b, head of same from above; c, head of same from the front; d, worker.

ferruginous red, gradually shading into the yellow color of the posterior portion. In soldiers from some nests the whole head is ferruginous, but always somewhat darker on the sculptured anterior portion. Segments of gaster each with a transverse brown band of variable breadth, but usually broadest on the terminal segments.

*Worker.* (Fig. 5, d.) Length, 3.5-4.5 mm.

Head longer than broad, not very convex in front, and with much more prominent mandibles than in the workers of *impressus* and *pylartes*. Clypeus nearly square, a little broader in front than behind, with a distinct median keel. Eyes large and flattened. Antennæ slender, scape surpassing the posterior angle of the head by about two-fifths of its length, but slightly enlarged towards its tip. Thorax shaped like that of the soldier, but more slender and more compressed in the meso- and metapleural regions. Petiole in profile acute above, with convex anterior and flat or even slightly concave posterior sur-

faces; upper border very sharp, in some specimens broadly but faintly excised in the middle when seen from behind. Legs like those of the soldier. Gaster proportionally smaller and more pointed.

Shining throughout and very finely shagreened; clypeus, front, and cheeks with faint, scattered punctures.

Hairs yellow; sparse and erect, on the clypeus, upper surface of the head and gaster; on the cheeks and legs appressed and so minute as to be almost imperceptible.

Pale yellow. Mandibular teeth black. Head and antennæ reddish; two or three terminal segments of gaster and in some specimens also the posterior portions of the preceding segments, infuscated.

*Female.* Length, 5.5–6 mm.

Head like that of the soldier but narrower, with parallel sides, ocelli and somewhat larger and more convex eyes. Thorax elongate, elliptical from above, about three times as long as broad; mesonotum nearly one and one half times as long as broad, somewhat flattened; epinotum rounded, with no angle between the basal surface and declivity, which is somewhat concave below. Petiole low and thick, rounded above, with flattened anterior and posterior surfaces. Legs and gaster like those of the soldier.

Sculpture, color, and pilosity as in the soldier. Wings whitish hyaline, with distinct yellow veins and stigma; wing-insertions dark brown.

*Male.* Length, 3.7–4.5 mm.

Head, including eyes, about as broad as long, with moderately prominent eyes and ocelli; cheeks subparallel, about as long as the convex posterior borders which pass gradually into the nearly straight occipital border. Mandibles narrow, toothless, pointed, when closed overlapping with the tips. Clypeus sharply keeled. Antennæ slender, scape half as long as the funiculus, which is filiform and of uniform thickness, except for the distinctly incrassated first joint. Thorax rather robust, mesonotum distinctly longer than wide, forming with the scutellum a regular ellipse. Basal surface of epinotum broadly rounded, declivity much shorter, obscurely concave below. Petiole small, anterior and posterior surfaces both somewhat convex, meeting above in a sharp transverse edge. Gaster and legs slender.

Shining throughout, minutely and obscurely shagreened.

Hairs pale and scattered, with about the same distribution as in the worker.

Yellowish brown; head behind, thoracic dorsum and gaster darker. There is a small deep black spot on the wing-insertions. Mandibles, mouth-parts, antennæ, legs, thoracic sutures, genitalia, and extreme basal portion of each of the gastric segments, pale yellow. Wings



whitish hyaline; veins and stigma pale yellow, less distinct than in the female.

Described from numerous specimens of all four phases taken at Austin, Texas, in the woody galls of *Holcaspis cinerosus* on the live-oaks (*Quercus virginiana*). The species is readily distinguished from *impressus* and *pylartes* by its pale color, the sharp borders of the truncated surface of the head and the shape of the thorax in the soldier and worker. In the latter character it resembles the European *truncatus*.

Professor Forel kindly compared some *etiolatus* females which I sent him, with the type of *abditus*, and called my attention to several slight differences in the proportions of the head, clypeus, etc., that would justify the description of the Texan form as a variety. Unfortunately the postal card on which Prof. Forel sometime ago indicated these differences has been mislaid among my papers, and I find myself unable to cite them from memory.

### III. THE HABITS OF *Camponotus* (*Colobopsis*) *pylartes* AND *C. etiolatus*.

As stated above, the workers of *C. pylartes* were occasionally seen running about singly on walnut leaves and twigs near Austin and New Braunfels. I was, however, unable to discover the nests in these localities. One day, while examining the dead limb of a hickory (*Hicorea myristicæformis*) in the sandy post-oak woods at Delvalle, a few miles from Austin, I saw a worker run along the bark and enter a small round hole which a moment before had been closed by the circular head of a soldier. As soon as the worker had entered, the soldier moved forward and again closed the opening. Other workers were soon seen returning and anon disappearing into the nest after gently knocking at the living portal with their delicate antennæ. This is an interesting demonstration of the existence of a purely tactile communication between ants, since the soldier's eyes and antennæ are in such a position when the head is in the opening that sight and smell cannot

be employed for the perception of workers approaching either from without or within the nest. Inasmuch as the soldier steps aside only when the tactile signal is given, that is, when the flat, truncated forehead is titillated by an incoming, or the tip of the gaster by an outgoing worker, and not when these surfaces are touched with a pin or a straw, we must suppose that some very simple form of tactile communication has been developed in these insects *pari passu* with the extraordinary adaptation of the soldier as sentinel and animated front door in one.<sup>1</sup>

When the hickory limb was broken in two, the nest was found to consist of a number of irregular galleries, apparently in great part the abandoned tunnels of some beetle larva, immediately under the bark. The galleries contained larvæ and nude pupæ, besides a few dozen workers and soldiers and a single virgin female. I was unable to ascertain whether this nest was merely one of several belonging to a single colony spread over different parts of the tree, but on still further breaking the limb, which was only about two feet long and one and one half inches in diameter, I found it to contain also a fine nest of *C. etiolatus* of essentially the same structure as the *pylartes* nest, except that the galleries extended into the hard wood, and a populous nest of *Camponotus marginatus* Latr. (var. near *discolor* Buckl.) also excavated in the hard wood. Certainly these three species must have been very tolerant to excavate their nests in such close proximity to one another. In the bark of the same and surrounding trees I found nests of *Macromischa subditiva* Wheeler, much like the nests of *Leptothorax canadensis* Prov. in our northern trees, and of *L. affinis* in Europe.

The ant-fauna of *Hicorea myristicæformis* may therefore be compared with that described by Forel as occurring in the Swiss nut-trees, both in respect of its composition (save for the absence of *Dolichoderus*), and in the tendency towards

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<sup>1</sup> I would emphasize the exclusion of sight and smell in this peculiar reaction, because Sharp's statement (Cambridge Natural History, Vol. VI, p. 138) that the *C. truncatus* soldier "sees a nest-fellow desirous of entering the nest" conveys an erroneous impression. The soldier merely feels the titillation of the worker's antennæ and at once responds with the appropriate, inherited reaction.

parabiosis among the component species. The same may also be said of the similar ant-fauna of the live-oaks of Central Texas. This fauna comprises the following species:

1. *Crematogaster lineolata* Say subsp. *laeviuscula* Mayr and its var. *clara* Mayr.
2. *Leptothorax obturator* Wheeler,
3. *Leptothorax fortinodis* Mayr,
4. *Camponotus marginatus* Latr., two varieties near *discolor* Buckley,
5. *Camponotus (Colobopsis) abditus* Forel var. *etiolatus* var. nov.



Fig. 6. Gall of *Holcaspis cinerosus* in section, showing colony of *C. (Colobopsis) etiolatus*, with soldier guarding entrance.

All of these ants except *L. fortinodis*, are of common occurrence in the spherical, woody galls produced by the cynipid *Holcaspis cinerosus* Bassett on the twigs of the live-oaks; all of them prefer to establish their colonies in these galls, and with the exception of the *Crematogaster*, each of the above species is able to bring its males and virgin females, as well as numerous workers, to maturity within these narrow confines. This is accomplished either in a single gall, as in the

case of the small colonies of *Leptothorax*, or by extending the colony over several galls. Nevertheless all of these species may be found nesting in other places. *Crematogaster clara* and *Camponotus marginatus* often nest in the dead wood of the live-oaks, the former also in lager walnut and pecan logs. *Leptothorax obturator* is very fond of taking possession of the abandoned nests of two species of tiny, steel-blue carpenter bees (*Ceratina nanula* Cockerell and *C. arizonensis* Cockerell) in the hollow twigs of the wafer-ash (*Ptelea trifoliata*) so common in the Texas creek-bottoms. *L. fortinodis* is sometimes found nesting in oak-bark, at least in the northern States, and *C. etiolatus*, as I have shown, may inhabit galleries of its own excavation in hard wood. This ant is, however, so common and regular a tenant of the *Holcaspis* galls that I have always been able to find a few colonies of it whenever I visited any large clump of live-oaks in or about Austin. I have therefore been able to study this species more closely than the rarer *C. pylartes*.

*C. etiolatus*, unlike *C. pylartes*, is nocturnal in its habits. This is indicated, first by the fact that I have never seen the workers abroad in the day-time, even when the galls containing the ants were kept for some weeks in a jar in the laboratory, and, second, by their pale yellow coloration. In this respect they resemble an exclusively nocturnal ant of the same genus, *Camponotus fumidus* Roger var. *festinatus* Buckley, which forms rather large colonies under stones on dry hillslopes in Central and Trans-Pecos Texas.

The colonies of *C. etiolatus* seem to be polydomous, as in *C. truncatus* of Europe. I infer this from the fact that galls on the same tree or even limb are found to contain workers, soldiers, and larvæ, but no queens. Moreover, when confined in the same jar, the workers from the different nests are quite friendly towards one another. The fertilized queen starts her colony in a single gall, and when her progeny become too numerous for these circumscribed quarters some of them emigrate with a portion of the brood to other galls on the same tree. The irregular central chamber made by the *Holcaspis* larva is enlarged by the ants and extended as a number

of short galleries into the hard, ligneous substance of the gall. The heads of the soldiers are just large enough to fit into the round hole through which the *Holcaspis* fly escaped (Figs. 6 and 7). In one gall four of these round holes were found and each was occluded by a soldier. In this case three of the holes must have been made by the ants. The *etiolatus* soldiers behave in the same manner as those of *pylartes* and

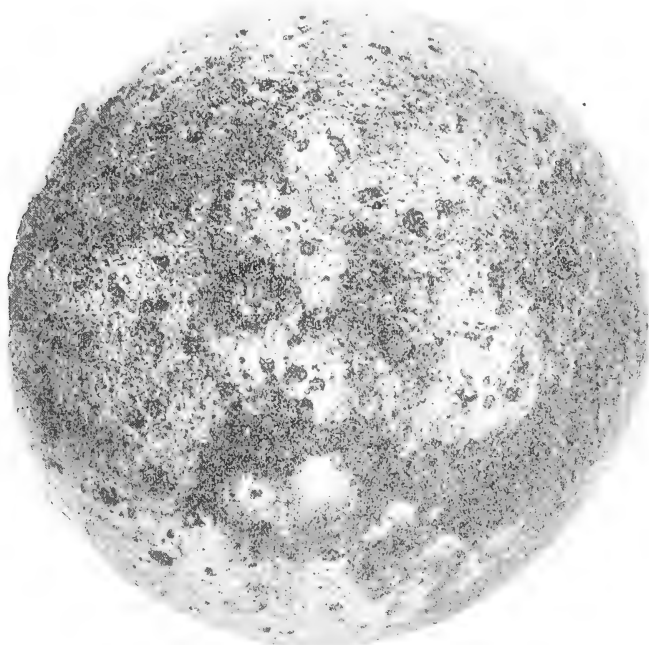


Fig. 7. Gall of *Holcaspis cinerosus* with head of a *C. (Colobopsis) etiolatus* soldier occluding the entrance to the nest.

*truncatus* towards workers entering or leaving the gall. When the activity of the workers is suspended during the day-time or during spells of cold weather, the soldiers remain at their post, carefully occluding the entrance for hours at a time. It is probable that they relieve one another at long and irregular intervals. This may perhaps be inferred from the fact that although there is commonly but a single entrance, the nest always contains more than one soldier. A census of 15

galls, collected from different trees in different localities, gave about 24.4 as the average number of ants in a gall, with an average of 4.9 soldiers and 19.5 workers. In other words, there are about four workers to one soldier. This approaches the ratio recorded by Forel for *C. truncatus* (see p. 143).

On one occasion I found a young queen that had just started her colony and was raising a small packet of larvæ. By replacing the slice of the gall cut away in exposing the central chamber and waiting for some time till the insect had regained her composure, she was seen to take up a position like the soldier, with her head occluding the entrance. This was perhaps to be expected from the configuration of her head, but it is an interesting fact, nevertheless, because it indicates that the isolated *Colobopsis* queen does not, like the isolated queens of many other ants, close the nest opening with earth or wood-filings till it is reopened by the first-born workers. <sup>1</sup>

The pupæ of *C. etiolatus* are always nude, as in the other species of the subgenus. The workers and soldiers are sharply separated from each other morphologically; at least I have never been able to find any mediæ, although I have examined the personnel of many nests for this particular purpose. The males and virgin females make their appearance earlier in the year than the fertile sexes of *C. pylartes*. I have taken them as early as the first week in May.

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<sup>1</sup> Although many Hymenoptera (bees, *Bembecidæ*, etc.) are in the habit of stopping the round entrances to their nests with their heads, I know of no instance in which the adaptation of the head to a circular orifice is so perfect as in *Colobopsis*. The wide range of convergent adaptations in insects is illustrated by a well-known American moth (*Cicinnna melshameri* Harris), the larva of which stops the round posterior opening of its case with the truncated, toughly chitinized hind end of the body. Another convergent adaptation is seen in the cephalic plates of certain tubicolous marine Annelids, like the *Maldanidæ*.

## Article XI. — A NEW GROUSE FROM CALIFORNIA.

By FRANK M. CHAPMAN.

### *Dendragapus obscurus sierræ*, subsp. nov.

#### SIERRA GROUSE.

*Chars. Subsp.* — Most nearly related to *Dendragapus obscurus*, but the nuchal region often browner and usually vermiculated with black, the whole dorsal region less black and more heavily vermiculated with brown and gray; terminal tail band narrower and more speckled with blackish; the median tail-feathers more heavily marked with gray or brownish; the scapulars and tertials with the terminal white wedge less developed or entirely wanting; the basally white neck-tufts practically absent; the throat averaging duskier and the feathers of the sides, flanks, and under tail-coverts with much less white.

Differs from *Dendragapus obscurus fuliginosus* in much paler coloration above, in the heavier vermiculation of the entire upper surface, practical absence of neck-tufts, whiter throat, and paler underparts.

*Type*, No. 79079, Am. Mus. Nat. Hist., Echo, El Dorado Co., California, July 18, 1896; P. O. Simons.

*Range.* — California in the forested portions of the Transition and Boreal zones, "east of the humid coast belt, and south through the Sierras to Mount Pinos" (Grinnell); north to Fort Klamath, Oregon.

Females of all three forms, in breeding plumage, are not certainly distinguishable from one another. The tail band in *obscurus*, however, averages wider, and in *sierræ* the central tail-feathers are less definitely barred.

A female from Sitka in fresh fall plumage (Sept. 10) is strikingly different from a female in similar plumage taken at Echo, El Dorado Co., October 7. The prevailing color of the former is rich, deep rusty and the bird suggests *Bonasa umbellus sabinei* in tone of coloration. The dominant color of the California bird, on the other hand, is gray, the feathers of the entire dorsal surface being widely margined with this color. The underparts in this example are much paler and whiter than in the Alaska bird.

The young of *sierræ* in juvenal plumage, of which the

collection contains twelve specimens, are all appreciably paler than two examples of *fuliginosus* in corresponding plumage.

The range of *Dendragapus obscurus* is given in Baird, Brewer, and Ridgway (III, p. 423) as "Rocky Mountain region of the United States, principally south of South Pass, and Sierra Nevada, north to Oregon and south to San Francisco Mountains, New Mexico." In the same work (p. 425) *D. o. fuliginosus* is said to inhabit the "Northwest coast region, from Oregon to Sitka."

In Ridgway's 'Manual' (first, 1887, and second, 1896, editions) the Sierras are not included in the range of any form of this species. The A. O. U. Check-List (second edition, 1895) gives the western limit of the range of *obscurus* as the "East Humboldt Mountains," while *fuliginosus* is said to inhabit the "northwest coast mountains, from California to Sitka, east to Nevada, western Idaho, and portions of British Columbia." Bendire (Life Histories of North American Birds, 1892, p. 44) as well as Grinnell (Check-List of California Birds, 1902, p. 30) also refer the Sierra grouse to *fuliginosus*.

It appears, however, on comparison of specimens of Sierra grouse, lately received by the Museum from W. W. Price, with series of *Dendragapus obscurus* and *D. o. fuliginosus*, very kindly loaned me by the U. S. National Museum through Mr. Robert Ridgway, and by Mr. William Brewster, that the form of *Dendragapus* inhabiting the Sierras is much more nearly related to *obscurus* than to *fuliginosus*. Curiously enough it follows, therefore, that the ranges accorded the birds of this group by Baird, Brewer, and Ridgway in 1875 are more nearly correct than those which have appeared in subsequent works.

In spite of the fact that the Sierra Grouse more nearly resembles *obscurus* than it does *fuliginosus* it apparently has been derived from the latter rather than from the former. That is, it represents a southern extension of the northwest coast form and not a westward extension of the Rocky Mountain form.

This theory is supported by the apparent continuity of range of *sierræ* and *fuliginosus* and by their evident intergradation in the vicinity of Klamath, Oregon. Several of the



specimens, in an admirable series collected by Major Bendire, at Fort Klamath, are referable to *sierræ* rather than to *fuliginosus*, though not typical of the former. Other examples in this series, however, are much nearer to *fuliginosus*. On the other hand, I have no material proving continuity of range in *sierræ* and *obscurus*, and the character of the country intervening between the nearest known portions of their respective ranges would lead one to suppose that they do not intergrade geographically.

Acknowledgments for the loan of material are due Mr. Robert Ridgway (39 specimens) and Mr. William Brewster (5 specimens).

*Material Examined.*

*D. o. richardsoni*. British Columbia: Fort Halkett, 1 ♂, 1 ♀; Ashcroft, 4 ♀ ♀, 3 juv.; Ducks, 1 ♀. Alberta: 60 miles west of Calgary, 2 ♂ ♂. Montana: 2 ♂ ♂.

*D. o. fuliginosus*. Alaska: Sitka, 2 ♂ ♂, 1 ♀; Gustavus Point, 1 ♂. British Columbia: Chilliwack, 1 ♂, 1 juv.; New Westminster, 2 ♂ ♂; Victoria, 1 ♂. Washington: 49th parallel, Mt. Baker Range, 1 juv.; Puget Sound, 1 ♂; Fort Steilacoom, 1 ♂; Clickatat River, 1 ♀. Oregon: Douglas Co., 1 ♂; foot of Mt. Hood, 1 ♂ (type); Canyonville, 1 ♀.

Intermediate between *fuliginosus* and *sierræ*. Oregon: Fort Klamath, 6 ♂ ♂ (2 nearer *fuliginosus*, 2 nearer *sierræ*), 4 ♀ ♀, 2 juv. California: near Oregon line, 1 ♀; Castle Lake, 1 ♀.

*D. o. sierræ*. California: Mt. Tallac (El Dorado Co.), 1 ♂, 1 juv.; Echo (El Dorado Co.), 2 ♂ ♂, 13 ♀ ♀, 11 juv.; near Lake Tahoe, 1 ♀; Big Trees, 1 ♂; Bloods, 1 ♂; Fort Crook, 1 ♂.

*D. o. obscurus*. Montana: Deer Creek, 2 ♂ ♂. Utah: Brown's Park, 1 ♀, 2 juv.; Fort George, 1 ♂, 1 ♀; Uintah Mts., 1 ♀. Arizona: White Mts., 2 ♂ ♂. Colorado: 1 ♂; Twin Lakes, 1 ♂, 1 ♀; Rio Grande, 1 ♂; Jimtown, 1 ♂; Huerfano Co., 1 ♂.

MEASUREMENTS OF NINETEEN MALES OF *Dendragapus obscurus*, *D. o. fuliginosus*,  
AND *D. o. sierræ*.

Name.	No.	Locality.	Date.	Wing.	Tail.	Gonys.	Tarsus.	Tail Band on mid. feathers.	Greatest Width Tail Band on Inner Web of Outer Rectrix.
<i>Fuliginosus</i> ..	N. M. 170281	Gustavus Point, Alaska.	June 10	218	158	10.3	45.5	16.	7.5
" ..	A. M. 47278	New Westminster, B. C.	Apr. 27	231	190	10.2	43.2	19.5	9.5
" ..	" 47277	New Westminster, B. C.	May 5	221	150	10.5	46.	13.	5.
" ..	W. B. 45642	Chilliwack, B. C.	May 13	217	169	11.8	47.	17.2	8.5
" ..	N. M. 153198	Victoria, B. C.	Mar. 27	214	152	10.5	43.5	17.	8.5
" ..	" 45051	Foot of Mt. Hood, Oregon.	—	232	157	11.	43.8	17.5	9.5
Average:				222	163	10.7	44.8	16.7	8.1
<i>Sierræ</i> .....	A. M. 79081	Mt. Tallac, El Dorado Co., Cal.	July 6	220	—	9.9	45.	—	10.5
" .....	" 79080	Echo, El Dorado Co., Cal.	Aug. 8	223	162	—	44.	15.	9.5
" .....	" 790791	Echo, El Dorado Co., Cal.	July 18	235	—	10.4	43.	—	10.
" .....	N. M. 85627	Bloods, Cal.	June 20	230	172	11.	45.4	21.5	9.5
" .....	" 18053	Fort Crook, Cal.	Mar. 19	238	183	11.	44.	21.	8.
Average:				229	172	10.6	44.3	19.2	9.5
<i>Obscurus</i> ....	N. M. 62652	Ft. George, Utah	June 10	223	180	10.3	47.	30.	15.
" ....	" 19164	Deer Creek, Mont.	Feb. 13	227	156	10.8	46.	32.	14.
" ....	" 112681	Jimtown, Colo.	Oct. 25	234	156	10.2	44.5	27.5	14.
" ....	" 112680	Colorado.	Nov. 10	241	157	10.1	46.	33.	12.5
" ....	" 163863	Huerfano Co., Colo.	Oct. 25	222	157	10.	44.	22.5	12.5
" ....	A. M. 45187	Twin Lakes, Colo.	July 28	232	170	10.3	46.	38.5	25.
" ....	N. M. 69771	Rio Grande, Colo.	June 10	238	179	10.6	48.5	30.	18.5
" ....	" 101427	White Mts., Ariz.	—	218	145	10.5	43.	23.	12.5
Average:				229	164	10.4	45.6	29.6	15.5

<sup>1</sup> Type.

NOTE. — N. M. = U. S. National Museum; A. M. = American Museum Natural History; W. B. = Collection of William Brewster.

Greatest width of tail-band on inner web of outer rectrix in females.

	Min.	Average.	Max.
<i>D. o. fuliginosus</i> ( 3 specimens).....	6.	7.7	9
<i>D. o. sierræ</i> (10 " ).....	8.	10.2	15.
<i>D. o. obscurus</i> ( 4 " ).....	10.	14.6	20.

## Article XII. — AN ARMADILLO FROM THE MIDDLE EOCENE (BRIDGER) OF NORTH AMERICA.

By HENRY FAIRFIELD OSBORN.

The most surprising discovery by the American Museum expedition of 1903 was that of the presence of true Dasypoda or Armadillos in the Middle Eocene or Bridger formation of Wyoming.

Mr. Walter Granger, who was in charge of this very successful expedition, announced the discovery as that of an Edentate; the four specimens, which have been skilfully worked out by Mr. Granger and Mr. Thomson, prove indeed to be closely related to the modern armadillos; the chief differences being the probable presence of a leathery instead of a bony shield, of an enamel covering on the single large caniniform teeth in the upper and lower jaws and the degeneration of other teeth.

This discovery confirms the suppositions of Marsh and Schlosser of the existence of Edentata in the North American Eocene; and the more specific theory of Wortman as to the presence of ancestral Gravigrada ("Ganodonta") in our Eocene, the result achieved by our expedition of 1896.

Thus the very important zoögeographical conclusion is reached that at least two suborders (Gravigrada and Dasypoda) existed on this continent during the early Eocene times, if not in the Cretaceous.

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Unfortunately these Armadillos, on the basis of less perfect material, have already been placed under another name and group. Dr. J. L. Wortman<sup>1</sup> referred portions of the jaws, of the skeleton, and of a mistakenly associated tibia, as a new genus, *Metacheiromys*, and a new family, *Metacheiromyidae*, to the new suborder *Cheiromyoidea*, and connected this type with the *Microsyopsidae* (animals of doubtful affinity, placed by

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<sup>1</sup> Studies of Eocene Mammalia in the Marsh Collection Amer. Jour. Science, Vol. XVI, Nov., 1903, pp. 345-352.

some authors with Lemurs, by others with Rodents), and with the Aye Aye or *Cheiromys* of Madagascar.

The type of *Metacheiromys* is unquestionably identical generically with the specimens discovered by our party. With Mr. Granger's aid I shall here present a brief diagnosis of the principal characters, to be followed later by an illustrated description.

## SUPERORDER EDENTATA.<sup>1</sup>

### Order LORICATA *Flower*.

#### Genus *Metacheiromys* *Wortman*.

#### *Metacheiromys dasypus*, sp. nov.

Type: Skeleton No. 11718 American Museum.

This animal is much larger than *M. marshi* Wortman, and presents a number of distinct specific characters. It exceeds in size a full grown specimen of *Dasypus sexcinctus*, but presents close osteological resemblances mingled with some more primitive and other more specialized characters. Taking *Dasypus* and *Tatusia* as the standard of comparison, therefore, the following are the principal characters of *Metacheiromys*:

Premaxillary reduced, crescentic. Maxillary with single, laterally compressed, pointed enameled canine (?) in anterior border, behind which is one vestigial tooth. In lower jaw one canine (?) and three (one precanine and two postcanine) vestigial teeth; sharp edentulous dentary border. Cranium broadly flattened posteriorly, and a large tympanic bulla as in *Dasypus*, unlike the degenerate tympanic ring of *Tatusia*. Neck short; anterior cervicals resembling those of *Tatusia*, but not coalesced. As in *Tatusia*, the neural spines of cervicals low, of dorsals enlarged anteriorly, diminishing gradually posteriorly. Dorsals without supplementary zygapophyses (*i. e.*, nomarthrous), exhibiting large lateral metapophyses which rise above the prezygapophyses as in *Tatusia*, probably for the support of a leathery dermal shield.

Anterior ribs short and broad, as in *Tatusia*. Clavicles longer and less curved than in *Tatusia*. Five sternals are preserved (6 are found in type of *M. tatusia*), more equal in length than in *Tatusia*; manubrium sterni of somewhat similar form.

Scapula very similar to that of *Tatusia*, with forked acromial process. Humerus with much longer delto-pectoral crest, and much

<sup>1</sup> Including TÆNIODONTA Cope, (GANODONTA Wortman).

broader condyles. Ulna more curved. Radius very similar in form. Metacarpals very abbreviate. Terminal phalanges longer and more pointed.

Additional characters are afforded by the skeleton of a much smaller animal belonging to a third species.

***Metacheiromys tatusia*, sp. nov.**

Type: Skeleton No. 11549 American Museum.

This animal is inferior in dimensions to either *M. marshi* or *M. dasypus*, apparently a more primitive form, and represented by an almost complete skeleton lacking the anterior portion of the skull. The chief additional characters are:

Three coalesced sacral; ilium narrow and rodlike; pubis and ischium deeply depressed as in *Tatusia* and Edentata generally; femur more broadly flattened below than in *Tatusia*; femur, tibia, humerus, and radius of about the same length; these similar proportions of fore and hind limbs separate this animal from *Tatusia*, in which the femur is very much longer than the humerus.

In this species the lateral metapophyses of the lumbar vertebræ are less elongate.

GENERAL CHARACTERS OF *Metacheiromys*.

Closely similar in its general osteology to *Tatusia* and *Dasypus*, but exhibiting a number of more primitive characters, such as free cervicals, more equal sternal segments, fore and hind limbs approximately equal in length, tibia and fibula separate; and certain more specialized characters, such as wide curvature of ulna, elongation of the delto-pectoral crest of humerus. Still more widely specialized is the dentition, which is practically abortive except for the tusklike upper and lower canines which are covered with enamel. These at first sight suggest the tusks of the sloth *Cholæpus*, but the lower tooth is apparently homologous with the canine. The most striking general feature is the extreme modernization of the skeleton; it lacks only the compound articulation of the dorsal vertebræ and the presence of ossicles in the dermal shield to be described as a fully developed armadillo.



## Article XIII. — NEW OLIGOCENE HORSES.

By HENRY FAIRFIELD OSBORN.

PLATES IV AND V, AND EIGHT TEXT FIGURES.

The explorations of the American Museum of Natural History under Messrs. Wortman, Matthew, and Gidley in the Oligocene have brought to light a large number of new species of horses which have been awaiting description for many years. It has become apparent that there were varied races of horses in the Oligocene, which gave rise to the great variety of horses which we have found in the Miocene.

It is hoped that the special explorations and researches on the evolution of the horse under the William C. Whitney Fund will enable us to connect these Oligocene and Miocene races in continuous series.

With the able coöperation of Mr. J. W. Gidley, who is in special charge of this branch of the work in the American Museum, the following revision is presented. The numbers refer to the chronological sequence of description of species of *Meshippus*, *Miohippus*, and *Anchitherium*, including the John Day types.

The distinctive characters are either persistent or progressive, namely: (1) Increase in size; (2) development of pre-orbital fossæ in the skull; (3) persistent bunodont or separate character of conules and cones as contrasted with (4) progressive union of cones and conules into more or less continuous and sharply defined crests; (5) hypsodont elongation of the crown as contrasted with (6) persistent primitive brachyodont condition; (7) appearance and development of the hypostyle; (8) proportions of the crowns correlated with greater or less elongation of the face; (9) size and proportions of  $pm^2$  and of  $m^3$ .

## SYSTEMATIC TABLE OF SPECIES FROM WHITE RIVER AND JOHN DAY BEDS.

PRESENT REFERENCE.	ORIGINAL NAME AND AUTHOR.	DATE AND PLACE OF PUBLICATION.	PUBLICATION OF FIGURE.	COLLECTION CLAIMING TYPE.
1. <i>Mesohippus bairdi</i> .	<i>Palaeotherium bairdi</i> Leidy.	1850, Proc. Acad. Nat. Sci. Phila., p. 122.	1854, Ancient Fauna of Neb., pl. x, figs. 14-21; pl. xl.	National Museum, Washington.
2. <i>Miolhippus condoni</i> .	<i>Anchilotherium condoni</i> "	1870, Proc. Acad. Nat. Sci. Phila., Vol. XXI, p. 112	1873, Ext. Vert. Fauna of West. Ter., pl. ii, fig. 5.	National Museum, Washington.
3. <i>Hypohippus australis</i> .	" <i>australe</i> "	1873, Ext. Vert. Fauna of W. Ter., pp. 250, 251.	With first description, pl. xx, fig. 19.	
4. (?) <i>Parahippus agrestis</i> .	" <i>agreste</i> "	1873, Ext. Vert. Fauna of W. Ter., pp. 251, 252.	With first description, pl. vii, figs. 16, 17.	National Museum, Washington.
5. <i>Mesohippus (?) bairdi</i> (Milk dent.).	" <i>cuneatum</i> Cope.	1873, Palaeont. Bull. No. 16, p. 7.	Not figured.	Am. Mus. Nat. Hist.
6. <i>Miolhippus anneciens</i> .	<i>Miolhippus anneciens</i> Marsh.	1874 (Mar.), Am. Journ. Sci. (3), Vol. VII, p. 249.	" "	Yale Museum.
7. (?) " <i>anceps</i> .	<i>Anchilotherium anceps</i> "	1874 (Mar.), Am. Journ. Sci. (3), Vol. VII, p. 250.	" "	" "
8. <i>Mesohippus celer</i> .	" <i>celer</i> "	1874 (Mar.), Am. Journ. Sci. (3), Vol. VII, p. 251.	" "	" "
9. <i>Mesohippus</i> sp.	" <i>exoletum</i> Cope.	1874 (Apr.), Ann. Rep. U. S. Geol. Soc., p. 496.	" "	(?) Am. Mus. Nat. Hist.
10. <i>Mesohippus equiceps</i> .	" <i>equiceps</i> "	1879 (1878), Proc. Am. Phil. Soc., Vol. XVIII, p. 73.	" "	" "
11. " <i>brachylophus</i> .	" <i>brachylophus</i> "	1879 (1878), Proc. Am. Phil. Soc., Vol. XVIII, p. 74.	" "	" "
12. <i>Mesohippus longicristis</i> .	" <i>longicristis</i> "	1879 (1878), Proc. Am. Phil. Soc., Vol. XVIII, p. 75.	1890 (Scott and Osb.), Bull. Mus. Comp. Zool., XIII, p. 88, fig. 12.	" "
13. <i>Anchilotherium præstans</i> .	" <i>præstans</i> "	1879, Am. Nat., Vol. XIII, pp. 462, 463.	1887, Am. Naturalist, Vol. XXI, p. 1069, fig. 36.	" "
14. (?)	" <i>ultimum</i> "	1886, Proc. Am. Phil. Soc., Vol. XXIII, p. 357.	Not figured.	" "
15. (?) <i>Mesohippus westoni</i> .	" <i>westoni</i> "	1889, Am. Nat., Vol. XXIII, p. 153.	" "	Canada Geol. Surv.
16. <i>Colodon longipes</i> .	(?) <i>Mesohippus longipes</i> Osb. and Wort.	1894, Bull. Am. Mus. Nat. Hist., Vol. VI, p. 214.	" "	Am. Mus. Nat. Hist.
17. <i>Mesohippus intermedius</i> .	<i>Mesohippus intermedius</i> Osb. and Wort.	1895, Bull. Am. Mus. Nat. Hist., Vol. VII, pp. 354-356.	Same publication as description, fig. 4, p. 355.	" "
18. (?) <i>Colodon copei</i> .	<i>Mesohippus copei</i> Osb. and Wort.	1895, Bull. Am. Mus. Nat. Hist., Vol. VII, pp. 356-358.	Not figured.	" "
19. <i>Mesohippus latidens</i> .	<i>Mesohippus latidens</i> Douglass.	1903, Annals Carn. Mus., Vol. II, pp. 161, 162.	Same publication as description, p. 161, fig. 7.	Carnegie Museum.



*Horses of Smaller Size from the Lower Oligocene or Titanotherium Beds.*

With one exception, so far as known, the horses of this stage are small, not over eighteen inches at the withers. The hypostyle is wanting or rudimentary in the superior molars.

8. **Mesohippus celer**  
Marsh.

Amer. Journ. Sci. (3),  
Vol. VII, 1874, p. 251.

Type: superior molars, Yale Museum,  $p^4-m^3$ .  
Measurements:  $m^1-m^3$ .027 (Marsh), .0295 (Gidley);  $m^1$  a. p. .010 by tr. .015;  $m^3$  a. p. .0085 by tr. .012. Locality: Miocene of Nebraska (Marsh).

Molar series somewhat smaller than those of *M. bairdi*; protoloph and metaloph nearly of equal length; molar crowns short, brachyodont, but more elevated than in *M. westoni*, less elevated than in *M. latidens* or in *M. bairdi*. No hypostyle.  $M^3$  of very small size.

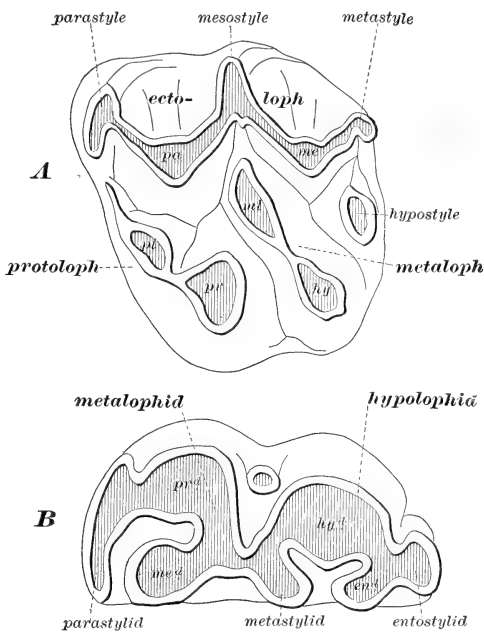


Fig. 1. Nomenclature of typical Equine molars.

15. **Mesohippus westoni** Cope.

Amer. Nat., Vol. XXIII, 1889, p. 153.

Type: a fractured upper molar and two lower molars of doubtful association, Ottawa Museum. Measurements: Superior molar a. p. .0095, tr. .012+; height of hypocone .004-, of ectoloph .005+; lower molar a. p. .0095. Locality: Swift Current Creek, Assiniboia, Canada.

Superior molar extremely primitive and brachyodont; transverse diameter proportionately great; crests low and obtuse;

persistent, well defined internal cingulum; protoloph with defined protoconule; metaloph continuous, with metaconule not clearly defined. No hypostyle.

19. **Mesohippus latidens** Douglass.

Annals Carn. Mus., Vol. II, 1903, pp. 161-162, fig. 7, p. 161. Type: superior molars, Carnegie Museum. Measurements:  $m^{1-3}$  .032;  $m^1$  a. p. .010 by tr. .016. Locality: Montana.

Much more progressive than *M. westoni*; crests more elevated; internal cingulum not continuous. Distinguished from *M. westoni* and *M. celer* by prominent parastyle and elongate protoloph, so that anterior half of the crown is much broader than posterior half. Hypostyle wanting.

20. **Mesohippus montanensis**, sp. nov.

Type: No. 9662 Amer. Mus.  $dp^2-dp^4$ ,  $m^1$ ; cotypes,  $dp^{2-4}$ , No. 9661,  $p^2-m^1$ , No. 9663, from the Pipestone Springs Beds, Montana. Measurement of type:  $m^1$  a. p. .0105 by tr. .014.

Distinguished from *M. celer* by full size of  $m^3$ ; from *M. westoni* by sharp elevation of crests and absence of internal cingulum; from *M. latidens* by smaller parastyle and subequal length of protoloph and metaloph. Molars more quadrate in form than in *M. latidens*. Protoconule quite distinct in protoloph; metaconule well defined on base of metaloph. Hypostyle absent or extremely rudimentary.

A forefoot associated with a single  $m^3$  of the same species exhibits a large splint of mtc. v.

*Upper Titanotherium Beds.*

21. **Mesohippus hypostylus**, sp. nov.

PLATE V, A.

Type: No. 1180 Amer. Mus., palate with complete series of teeth on both sides,  $p^1-m^3$ . From Cheyenne River, S. Dakota. Measurements:  $p^1-m^3$  .075;  $m^{1-3}$  .032;  $m^1$  a. p. .010 by tr. .0135; vertical hypocone .006, ectoloph .0075.

Distinguished from the preceding species by (1) a clearly

defined but rudimentary hypostyle just budding off from the posterior cingulum, (2) by protoloph tending to unite with paracone; from *M. bairdi* by more rudimentary hypostyle and less elevated crests. Metaloph sharp; metaconule

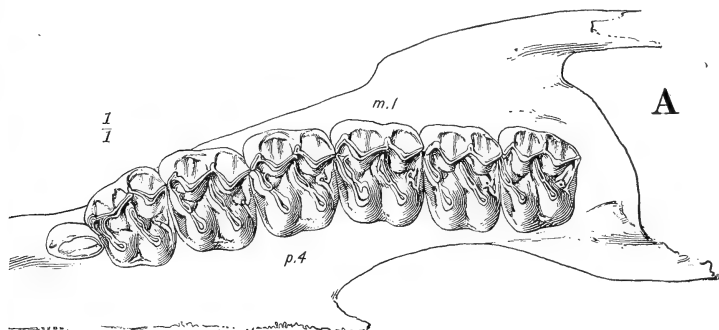


Fig. 2. *Meshippus hypostylus*, sp. nov. Type. No. 1180 Am. Mus.

not defined at base.  $Pm^1$  small. Skull with preorbital fossa apparently deeper than in *M. bairdi*.

## 22. *Meshippus proteulophus*, sp. nov.

Type: upper teeth,  $p^4-m^2$ , No. 514<sub>a</sub> Amer. Mus., Cotype lower jaw, No. 8 Amer. Mus. From the upper Titanotherium Beds, Cheyenne River, South Dakota.

This is a relatively large animal for the Titanotherium Beds, and is the oldest horse known with perfect crests on the molar teeth — hence the name *proteulophus*. The superior molars are readily distinguished by: (1) their large size;  $p^3-m^2$  measure .037 mm. as compared with .0335 for the same teeth in *M. bairdi*; (2) by the primitive absence of a distinct hypostyle; (3) especially by the very advanced or progressive condition of the proto- and metalophs which are continued to the ectoloph, and are very little divided, thus resembling those of *M. eulophus*; (4) the external cingulum sweeps upward across the parastyle instead of rising with it.

The cotype lower teeth  $p_2$  to  $m_3$  measure 79 mm., indicating an animal of large size.

*Horses of Intermediate Size, Middle Oligocene, Oreodon Beds.*

All the known species of horses of this and overlying beds exhibit a hypostyle on the molars. The horses are between 18 and 20 inches at the withers.

1. *Meshippus bairdi* Leidy.

## PLATE IV.

Proc. Acad. Nat. Sci. Phila., 1850, p. 122. Ancient Fauna of Nebr., 1854, pl. x, figs. 14-21, pl. xi.

Type: a skull and teeth, misplaced at present. Horizon not recorded, probably Lower Oreodon Beds. Measurements:  $m^{1-3}$  .032;  $M^1$  a. p. .011 by tr. .014; estimated from Leidy's figures.

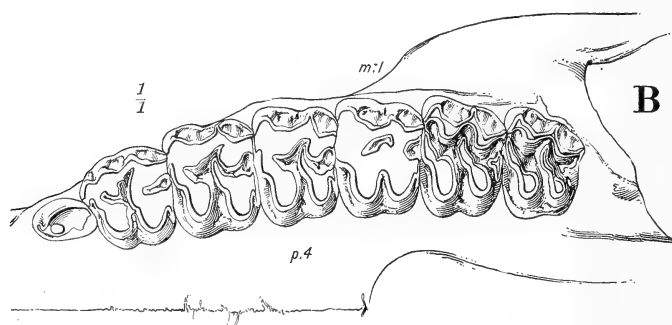
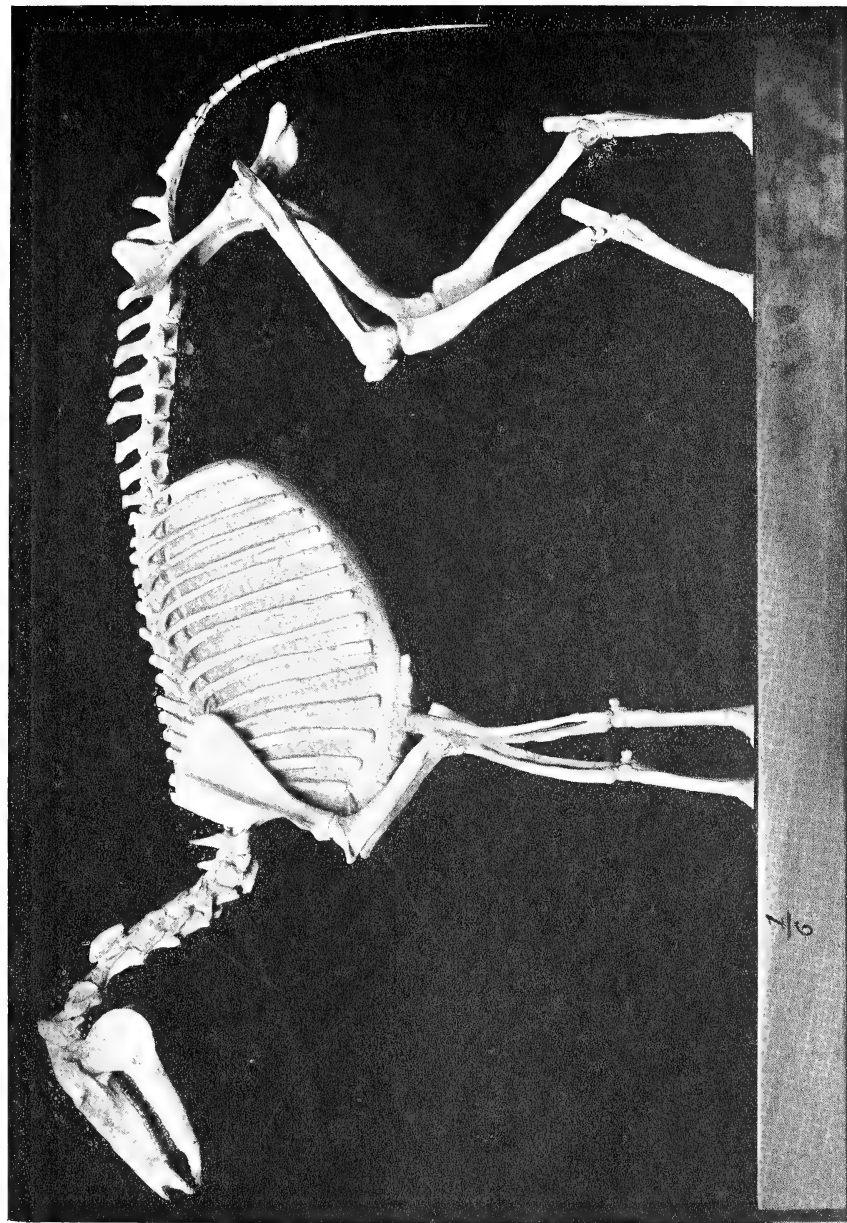


Fig. 3. *Meshippus bairdi*. No. 1477 Amer. Mus.

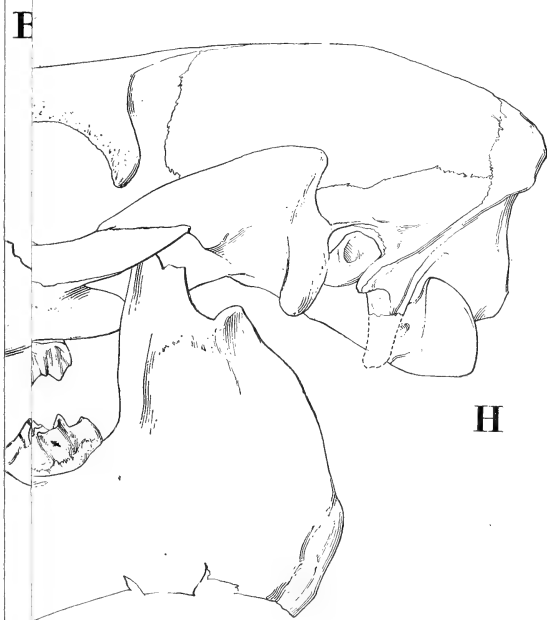
Skull with a shallow preorbital fossa. Molars with more elevated crests than in species described above, excepting *M. montanensis* and *M. proteulophus*. Hypostyle present and well developed, but still connected with posterior cingulum. Protoloph interrupted by protoconule, tending to unite with parastyle. Metaloph more sharp and continuous. Parastyle broad.

A skull and skeleton, No. 1477 Amer. Mus., almost identical with Leidy's type, was found in the Lower Oreodon Beds of South Dakota; it is figured in Plate V, B. Another specimen in the Princeton Museum (No. 11367), found by J. W. Gidley, tends to confirm the Lower Oreodon level as that of *M. bairdi*.



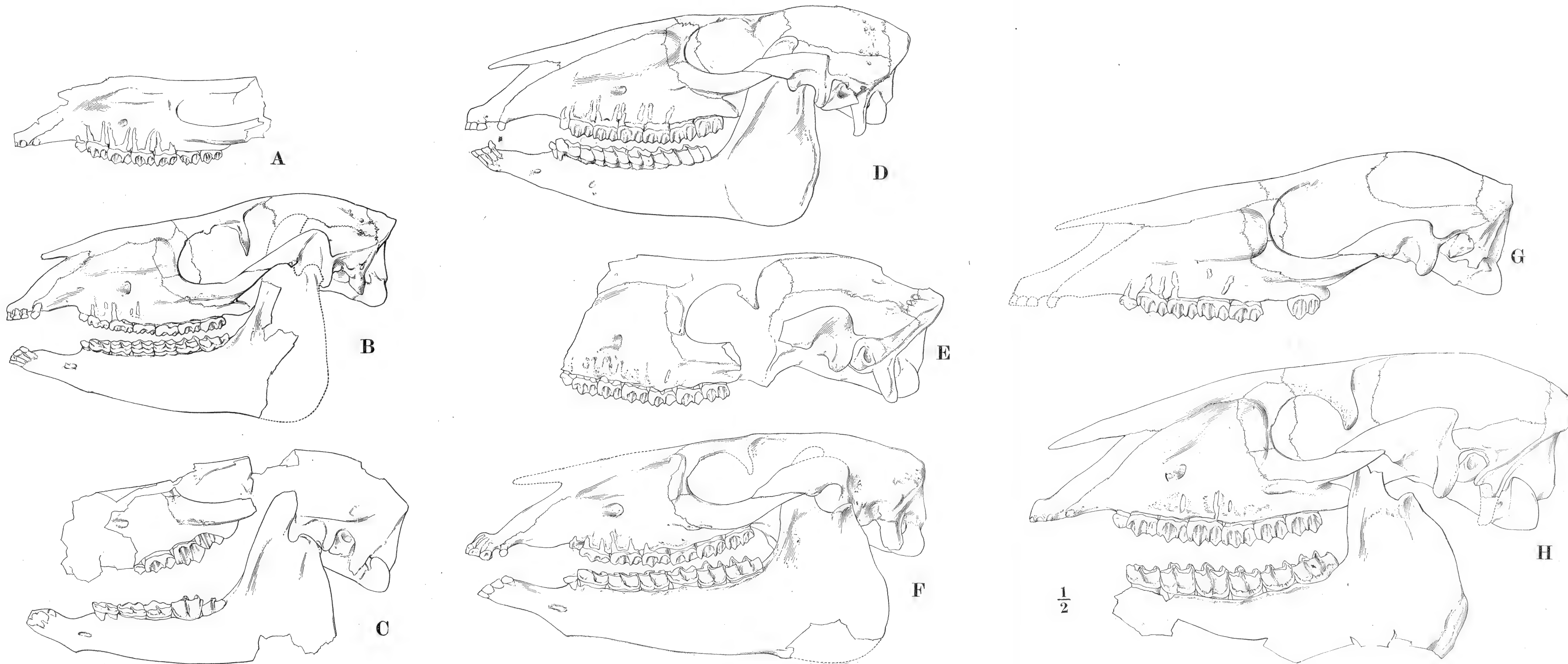
MESOHIPPUS BAIRDI. No. 1492 AMER. MUS.











## OLIGOCENE HORSES.

- A. *Meshippus hypostylus*. Type, No. 1180 Amer. Mus.  
 B. " *bairdi*. No. 1477 Amer. Mus.  
 C. " *obliquidens*. Type, No. 668 Amer. Mus.  
 D. " *meulophus*. Type, No. 1210 Amer. Mus.

- E. *Meshippus brachystylus*. Type, No. 11860 Amer. Mus.  
 F. " *intermedius*. Type, No. 1196 Amer. Mus.  
 G. *Miohippus gidleyi*. Type, No. 1192 Amer. Mus.  
 H. *Meshippus validus*. Type, No. 680 Amer. Mus.



9. **Mesohippus exoletus** Cope.

Ann. Rept. U. S. Geol. Surv. Apr. 1874, p. 496.

Type: misplaced. Species at present indeterminate.

23. **Mesohippus obliquidens**, sp. nov.

## PLATE V, C.

Type: skull and jaws, No. 668 Amer. Mus.; young individual with milk teeth *in situ*. From the nodular layer in lower middle layer of the Oreodon Beds; specimen covered with ferruginous oxide. Measurements: lower jaw from condyle to symphysis .149;  $m^1$  a. p. .013 by tr. .015.

This is the larger horse of the Oreodon Beds, with long-crowned teeth.

Distinguished from other species of the Oreodon Beds by (1) large size of skull and teeth as compared with *M. bairdi*, (2) pre-orbital fossa shallow or wanting, (3) but especially by the high crowns of upper and lower molars: ectoloph of  $m^1$  measures .0105 vertical as compared with .008 in an unworn  $m^1$  crown of *M. bairdi*, (4) metaloph elevated, metaconule not being clearly defined, (5) proto- and metalophs directed obliquely backward at a sharp angle with ectoloph, to which fact the name *M. obliquidens* refers.

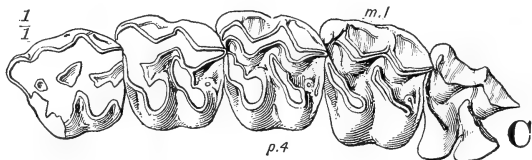


Fig. 4. *Mesohippus obliquidens*. Type. No. 668, Amer. Mus.

24. **Mesohippus eulophus**, sp. nov.

Type: complete superior dental series and portion of cranium, No. 8791 Amer. Mus. Found by Dr. F. B. Loomis in the Upper Oreodon Beds (Horizon B) of Cedar Creek, Colorado. Measurements:  $p^1$ - $m^3$  .076;  $m^1$ - $m^3$  .036;  $m^1$  a. p. .0115 by tr. .015;  $m^3$  a. p. .0123 by tr. .015.

The name *eulophus* is assigned in reference to the perfect or continuous and uninterrupted condition of the transverse crests.

Distinguished from *M. bairdi* by (1) deep preorbital fossa, which is deeper also than in *M. hypostylus*; (2) large size

of  $m^3$ ; (3) protoloph with very faint protoconule, and strongly connected with parastyle, constituting a nearly perfect anterior crest; metaloph also continuous; (4) as in *M. meteulophus*  $m^1 - m^3$  exceed in linear measurement  $p^2 -$

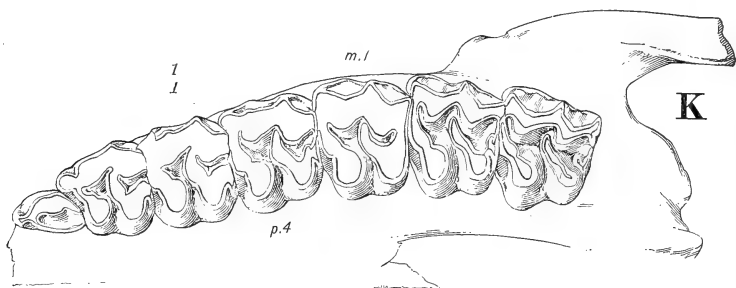


Fig. 5. *Mesohippus eulophus*. Type. No. 8791, Amer. Mus.

$p^4$ ; (5)  $p^4$  slightly narrower than  $m^1$ ; (6) series of grinding teeth,  $m^2 - p^2$ , narrowing anteriorly.

This species is apparently ancestral to *M. meteulophus* and to *Hypohippus* of the Miocene.

*Upper Oligocene, Leptauchenia Beds.*

25. **Mesohippus meteulophus**, sp. nov.

PLATE V, D.

Type: skull and jaws, Amer. Mus. No. 1210. Measurements: condyles to premaxillaries .215;  $p^1 - m^3$  .078;  $m^1 - ^3$  .038;  $m^1$  a.p. .013 by tr. .017.

This species is a successor of *M. eulophus*, from which it is distinguished (1) by its decidedly more elongate or hypsodont molar crowns, the crests being .002 higher; (2) by its larger size; (3) unlike *M. eulophus*  $p^4$  is broader than  $m^1$ , a progressive stage towards the equine condition; (4) it accents the *M. eulophus* character of the heavy but continuous meta- and protoloph which are not distinctly interrupted by conules. In the ectoloph the parastyle, mesostyle, and ribs are sharply defined but not prominent, in fact, the ectoloph is somewhat flattened. (5) Another feature is that the protoloph is more elongate

transversely than the metaloph, causing these crests to be somewhat asymmetrical as in *M. latidens*.

While more progressive than *M. intermedius* in these respects, this species is sharply distinguished by the fact (6) that the hypostyle rises directly on the posterior cingulum; it is not in the least separate. It differs from *M. gidleyi* in the conformation of the crests, the small size of  $pm^2$ , and the large size of  $m^3$ .

It resembles *Hypohippus* in: (7) external cingulum crosses base of parastyle, (8) crests are simple and continuous, (9) postfossette is fully formed in premolars, (10) preorbital fossa is simple, long, and deep, (11) flattened or angulate parastyle.

## 26. *Mesohippus brachystylus*, sp. nov.

PLATE V, E.

Type: skull, No. 11860 Amer. Mus. Collected by H. F. Wells in Leptauchenia Beds, Cheyenne River, South Dakota. Measurements:  $p^1-m^3$  .082;  $m^1-m^8$  .038;  $m^1$  a. p. .0135, tr. .0175;  $m^8$  tr. .0155.

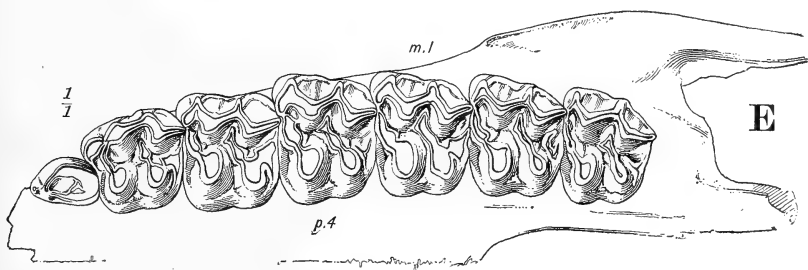


Fig. 6. *Mesohippus brachystylus*. Type. No. 11860, Amer. Mus.

The name refers (1) to the broad rounded parastyle, readily distinguishable from the flattened angulate parastyle of *M. eulophus*, *M. meteulophus*, and *Hypohippus*.

This species is further distinguished by: (2) depressed proto- and metalophs, (3) protoloph interrupted, with large oval protocone and distinct protoconule, uniting externally with parastyle, as in *M. bairdi*, (4) ectoloph with broad prominent rounded parastyle and defined mesostyle, ribs defined, (5)

hypostyle connected with cingulum but giving off a strong outward spur, (6) a broad, shallow preorbital fossa.

This horse, which is larger than *M. bairdi*, appears to be one of its successors, although of larger size and in some respects ancestral to the type of *M. intermedius* of the Protoceras Beds through a simpler intermediate stage, Amer. Mus. No. 1218.

*Horses of somewhat Larger Size, Upper Oligocene, Protoceras Beds.*

16. “(?) *Meshippus*” *longipes* Osborn and Wortman.

= *Colodon longipes*.

Bull. Am. Mus. Nat. Hist., Vol. VI, 1894, p. 214.

Type: the type of this species is a foot which has since been determined as belonging to the lophiodont species *Colodon longipes*.

17. *Meshippus intermedius* Osborn and Wortman.

PLATE V, F.

Bull. Amer. Mus. Nat. Hist., Vol. VII, 1895, pp. 354-356. Fig. 4, p. 355.

Type: skull and parts of skeleton, Amer. Mus. No. 1196. Measurements: condyles to symphysis .218;  $p^1-m^3$  .088;  $m^1-^3$  .040;  $m^1$  a. p. .0135 by tr. .018.

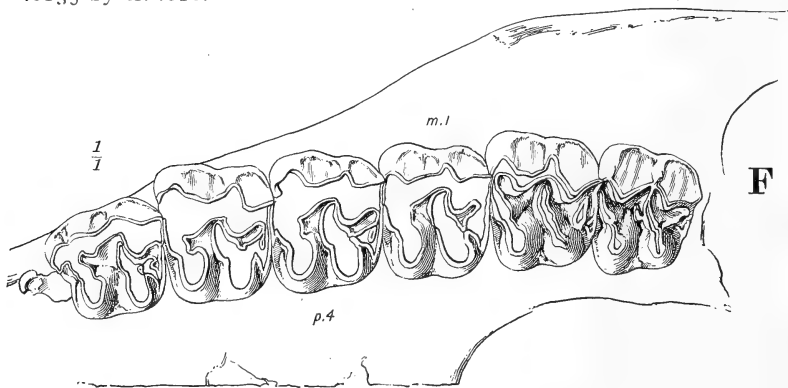


Fig. 7. *Meshippus intermedius*. Type. No. 1196, Amer. Mus.

(1) Skull with large and apparently undivided preorbital fossa. (2) Hypostyle separated and distinct or only slightly connected with posterior cingulum; in some specimens, *e. g.*

Amer. Mus., No. 1043, it is still partly connected. Despite the foregoing progressive characters, (3) the protoloph is decidedly interrupted by the protoconule, (4) the molars are more brachyodont than in *M. meteulophus*. (5) The parastyle is broad and rounded when worn, as in *M. brachystylus* and *M. bairdi*.

This species is also represented in the Amer. Mus., by skull No. 1218 and palate No. 1043 which exhibit the same characters.

18. **Meshippus copei** Osborn and Wortman.

= (?) *Colodon copei*.

Bull. Am. Mus. Nat. Hist., Vol. VII, 1895, pp. 356-358.

Type: pelvis, femur, tibia, and part of hind foot, Amer. Mus. No. 1197, from Protoceras Beds.

The pelvis, the part first mentioned, belongs to some species of rhinoceros or lophiodont, and is certainly not that of a horse.

The association of the other parts proves to have been erroneous. The femur does not belong to the pelvis. The identification of the tibia and astragalus has not been made; both bones are, however, equine and may be provisionally referred to *Miohippus crassiscus*.

27. **Meshippus validus**, sp. nov.

Type: skull, jaws, and portions of limbs, Amer. Mus. No. 680, from the Protoceras Beds of South Dakota. Measurements:  $p^1-m^3$  .104;  $m^1-m^3$  .047;  $m^1$  a. p. .0165, tr. .021. Condyle to pmx. symphysis .250 + .

This is a large horse standing not less than 28 inches at the withers. The species is readily distinguished from *M. intermedius* as follows: (1) elevated ectoloph, .013, parastyle broad, ribs marked, (2) metaloph short, well separated from ectoloph, (3) protoloph interrupted, protocone indented, (4) hypostyle, < shaped or triangular, connected with cingulum and with a strong outward spur, (5) preorbital fossa subdivided by a low median ridge into anterior and posterior depressions.

This species is admirably represented by skull No. 680, Amer. Mus., also by skull No. 10733, Princeton Museum.

[May, 1904.]

28. *Miohippus gidleyi*, sp. nov.

PLATE V, G.

Type: a skull, No. 1192 Amer. Mus. Measurements:  $p^1-m^3$  .0975;  $m^1-m^3$  .042;  $m^1$  a. p. .0145 by tr. .019.

This species is readily distinguished by the moderately elongate crown, the interrupted transverse crests (proto- and metalophs) of the premolar teeth, the nearly or quite continuous internal cingulum on the grinders. Its affinities are with the genus *Miohippus* Marsh.



Fig. 8. *Miohippus gidleyi*. Type. No. 1192, Amer. Mus.

This animal is also somewhat larger than *M. intermedius*, which however it resembles: (1) in the presence of preorbital fossa, (2) the sharpness of the metaloph of the molars. It is more primitive than *M. intermedius* in (3) the somewhat larger size of  $pm^1$ , (4) hypostyle large but still connected with posterior cingulum, (5) internal cingulum persisting, quite strong especially on the premolars, (6) ectoloph more elevated than the protoloph or metaloph.

Special characters which may prove to be distinctive are (7) the crenulation of the enamel surface of the premolars especially, (8) rudimentary spur or crochet from metaloph, (9) external cingulum tends to cross base of parastyle, (10) protoloph longer than metaloph in premolars.

Its characters are confirmed by a specimen (No. 10501) in the Princeton Museum, which is slightly more progressive.

This species is named in honor of Mr. J. W. Gidley who has devoted himself with such great success to the explorations for fossil horses under the Whitney Fund.

29. *Miohippus crassicuspis*, sp. nov.

Type: 2nd and 3rd right upper premolars, Amer. Mus. No. 683. Measurements:  $p^2-3$  measure together .035. In *M. intermedius* the same teeth measure .031.

These teeth, which were mistakenly associated with the pelvis of *Colodon* (*Mesohippus*) *copei*, are now found to closely resemble those of *M. annectens* Marsh from the John Day Beds.



The distinctive characters of the type are (1) the highly interrupted transverse crests of the premolars, the cones and conules being quite distinct and separate, (2) internal cingulum strong but not continuous, (3) in the median valley are low, transverse ridges, which rise into cuspules in the related species *M. annectens*, (4) sides of the inner crests crenulate, as in *M. gidleyi*, (5) unlike *M. gidleyi*, hypostyle strong and nearly separated from posterior cingulum.



## Article XIV. — MANUS, SACRUM, AND CAUDALS OF SAUROPODA.

By HENRY FAIRFIELD OSBORN.

DINOSAUR CONTRIBUTION No. 7.

The following notes on new materials from the Bone Cabin Quarry in the American Museum were prepared for the U. S. Geological Survey monograph on the Sauropoda, and partly correct previous papers. I am indebted to Mr. Walter Granger, who has charge of the Bone Cabin collection, for several valuable observations, and to Director Charles D. Walcott of the Survey for permission to publish in this form.

### I. STRUCTURE OF THE MANUS.

My previous figures and descriptions of the manus are all incorrect.

*The single Claw on Digit I.* — From two specimens in the Field Columbian Museum, from the correctly described (Hatcher) and figured manus of *Brontosaurus* in the Carnegie Museum, and from eight specimens in the American Museum, it appears as if in the manus of *Diplodocus*, *Brontosaurus*, and possibly of *Morosaurus*, there was but one claw, and that a small one, on the pollex. Two specimens only in the American Museum (Nos. 276, 332) exhibit two claws, but both are of very doubtful association.

The *oblique direction* or partial *retroversion* of this pollex claw (D. I.) is a feature to which Dr. E. S. Riggs especially directed my attention; the inferior facet of Mtc. I, and the two facets of the proximal phalanx are bevelled in such a manner as to give an oblique outward and slightly backward angle to the terminal or claw phalanx; the retroversion, however, is much less marked than in the manus of the Theropoda.

*Phalanges reduced.* — The first phalanges on D. II–V all terminate, like the phalanges of D. IV and D. V, in the pes of some species, in non-faceted, peculiarly spread surfaces which apparently bore no second or additional phalanges.

*Amphiaxonic Manus.* — The manus in these two specimens

is more properly amphiaxonic than mesaxonic (Osborn) or entaxonic (Hatcher). The five digits distribute the weight about equally.

*Coalesced Carpalia 1-3*. — The large element which I described as a scapho-lunar (or radiale + intermedium) has been observed by Mr. Granger to fit very closely by distinct facets on top of Mtc. I and Mtc. II, also to rest partly on Mtc.

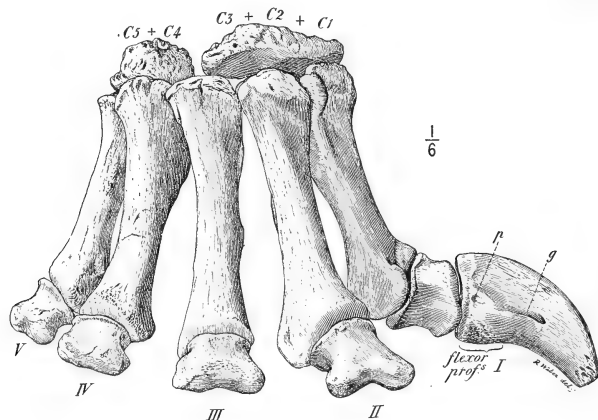


Fig. 1. Manus of *Morosaurus* sp. No. 965, Amer. Mus.  $\times \frac{1}{6}$ . *p*, pit; *g*, groove.

III. It therefore represents the distal carpalia 1-2 or 1-3 instead of radiale + intermedium as I supposed.

The other large element probably represents carpalia 4-5 and rests on Mtc. IV and Mtc. V.

The proximal elements of the carpus thus were cartilaginous or remain unaccounted for.

The wrist joint *appears* to have been between the radius and ulna and the distal carpalia instead of the proximal carpalia, thus presenting an analogy with the intratarsal joint of the pes. This point, however, requires confirmation.

## 2. SACRO-PELVIC ARCADE.

The following observations are based on three unusually complete specimens from the Bone Cabin Quarry, which in part confirm, in part disprove, and in several points amplify

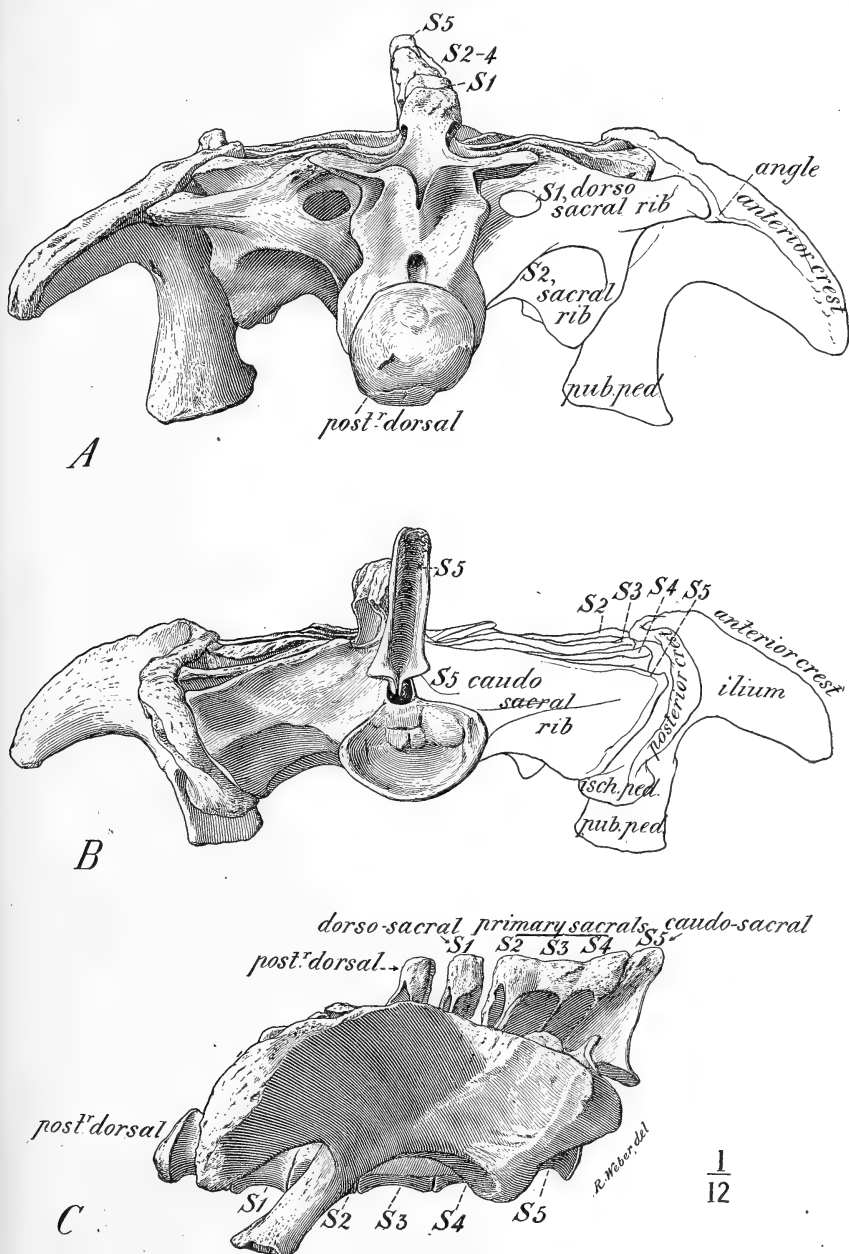


Fig. 2, A-C. Anterior, posterior, and left lateral views of the ilium and sacrum of *Morosaurus* sp. No. 690, Amer. Mus.  $\times \frac{1}{12}$ . *pub. ped.*, pubic peduncle of ilium; *isch. ped.*, ischiadic peduncle of ilium.

previous observations by Marsh, Osborn, Williston, Hatcher, and Riggs.

In comparison with sacra already described they demonstrate the existence of several forms of sacral structure in the Sauropoda.

The vertebral and rib + diapophysial elements composing the sacrum in these three specimens may be clearly distinguished as follows:

I. One or two dorso-sacra, more or less modified, with expanded dorsal ribs.

II. Three primary sacra, with large, expanded sacral ribs.

III. Caudo-sacral with a modified caudal rib.

The key to the position of the single-headed primary sacral and caudal ribs is found in the Protorosauria (*Palæohatteria*, *Protorosaurus*), the probable ancestors of the Dinosaurs, in which these ribs spring low down from opposite the centra.<sup>1</sup>

*Morosaurus*.

(Fig. 2, A-C, Fig. 2, D, E.)

The sacral arcade of the aged individual (Amer. Mus. No. 690) is built up of five vertebræ as follows: *S. 1*, a dorso-sacral, or recently modified posterior dorsal; a bicipital rib (Fig. 2, A) with elevated attachment of capitulum; rib flaring distally, to unite with antero-internal angle of inner face of ilium, forming part of the posterior boundary of the abdominal cavity, ascending to the superior border, and sending off an inferior branch to unite with the outer portion of the first primary sacral rib and pubic peduncle of the ilium, but not entering the sacral plate. *S. 2-4*, the three primary sacra, with closely coalesced neural spines (Fig. 2, C) and expanding rib plates and diapophyses, all entering sacral plate, also forming portion of the acetabulum (Fig. 2, D). *S. 5*, caudo-sacral with neural spine coalesced at base with the primary sacral neural spines, broadly expanding rib plate entering back portion of sacral plate and ischiadic peduncle, but not forming portion of acetabulum.

<sup>1</sup> The Reptilian Subclasses Diapsida and Synapsida and the early history of the Diaptosauria. Mem. Amer. Mus. Nat. Hist., Vol. I, Pt. viii, Nov., 1903, p. 502.

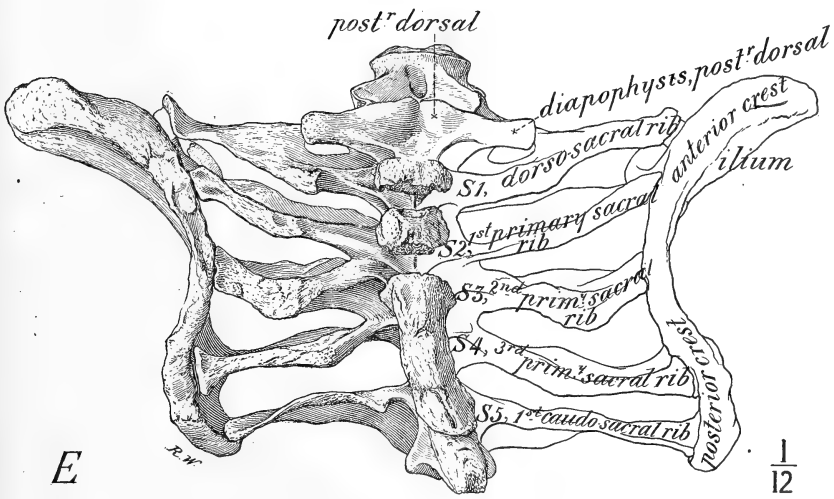
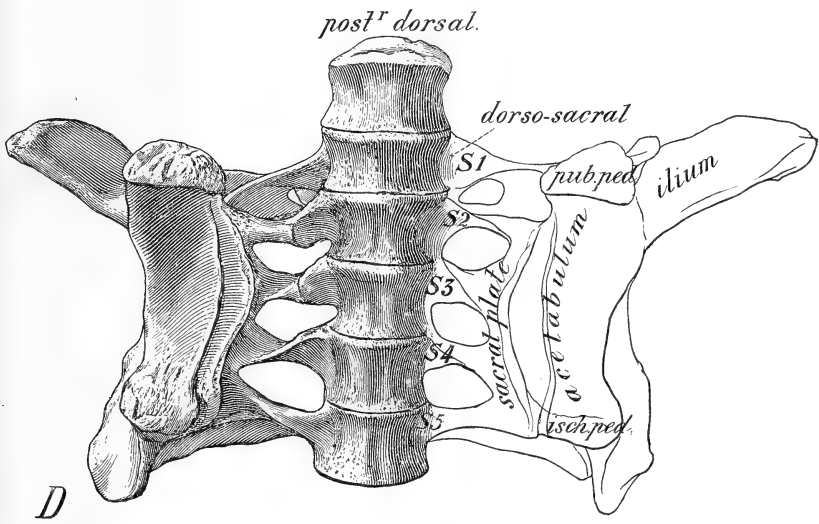


Fig. 2, D, E. Inferior and superior view of same specimen. (See Fig. 2, A-C.)

This proves that *Morosaurus*, including the dorso-sacral, has five sacral vertebræ, the centra of which diminish in size from first to last, unlike those of *Diplodocus* and *Brontosaurus*.

*Diplodocus.*

(Fig. 3, A-B.)

The morphology of the sacral arcade is still more perfectly shown in a young *Diplodocus* (Amer. Mus. No. 516) in which all the dorsals, sacrals, and anterior caudals were found interlocked, leaving no question as to the enumeration. The 10th or posterior dorsal vertebra shows its capitular attachment of the rib opposite the pleurocœle.

S. 1, the 11th dorsal or first dorso-sacral, exhibits a slender rib plate (*r. 1*), capitulum rising opposite pleurocœle at a point slightly lower than in the true dorsal, diapophysial lamina expanding laterally to unite with the angle on the antero-internal face of the ilium, which constitutes the posterior boundary of the abdomen; this rib sends off a small independent spur to the pubic peduncle, but does not unite with the sacral plate proper. S. 2-4, three primary sacrals; first and second primary sacrals (S. 2-3) with short centra, large ribs attached below pleurocœle on sides of centra, expanding dorsally into rib plates confluent with the diapophysial laminæ; third primary sacral (S. 4) with very long centrum, sacral rib (*r. 4*) attached above pleurocœle as in caudo-sacral. S. 5, caudo-sacral, with heavy sacral rib attached above pleurocœle uniting distally with posterior border of sacral plate and posterior crest of ilium.

*Brontosaurus.*

(Fig. 4, A, B, C.)

The sacrum and pelvis (Amer. Mus. No. 675) is exceptionally complete; it exhibits six sacrals disposed as follows:

S. 2, a posterior dorsal (probably dorsal No. 10), or first dorso-sacral; spine and centrum elevated, bicipital rib with shaft flaring laterally and broadly uniting with the angulate antero-internal face of the ilium (Fig. 4, A); a narrow in-



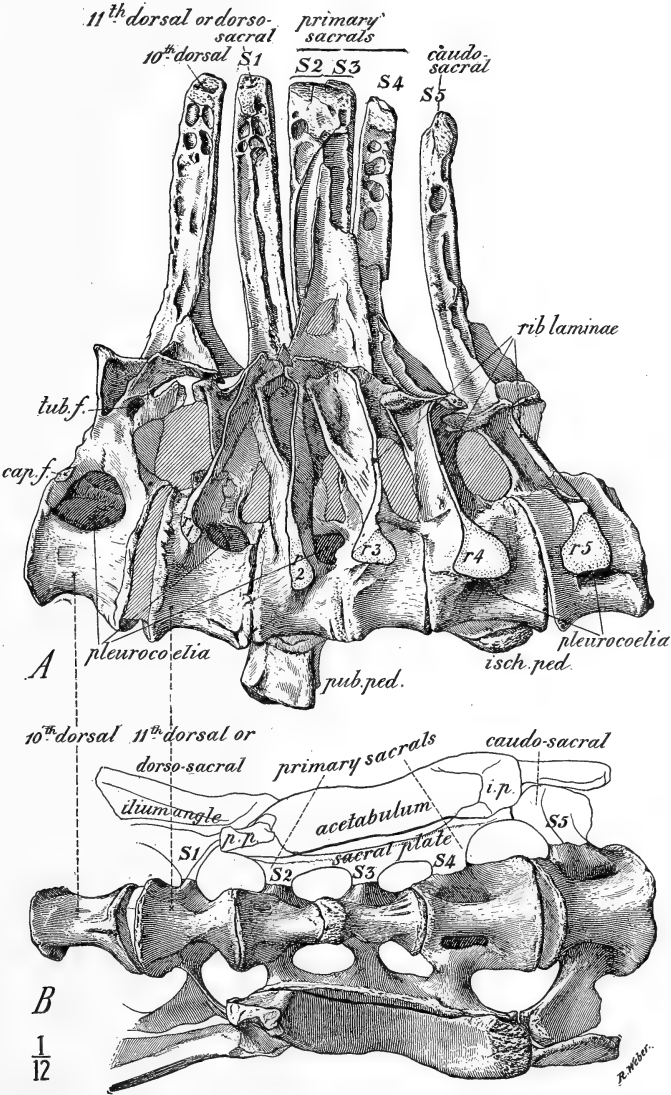


Fig. 3, A-B. Sacrum of *Diplodocus longus*. Left lateral and inferior views. No. 516, Amer. Mus.  $\times \frac{1}{12}$ .

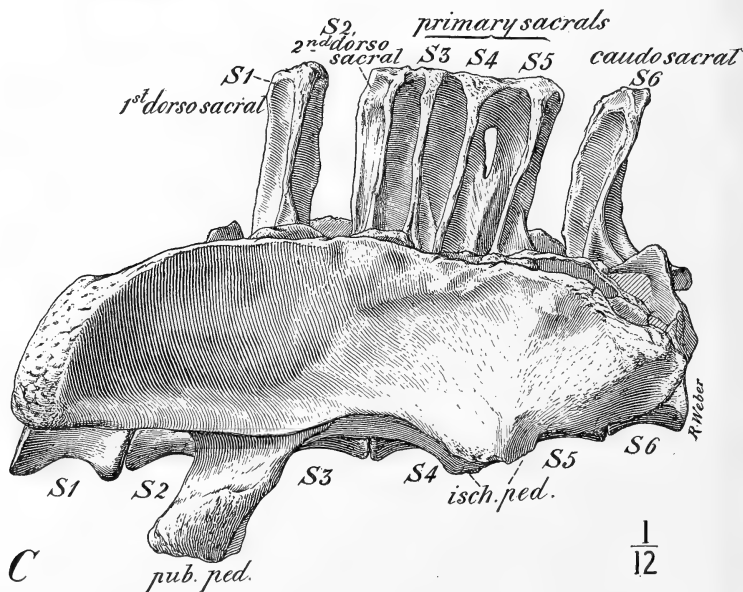
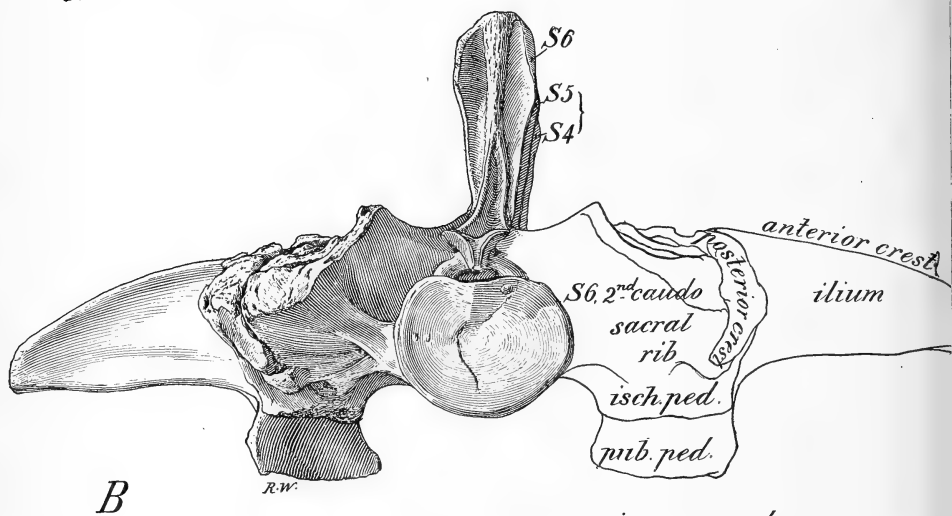
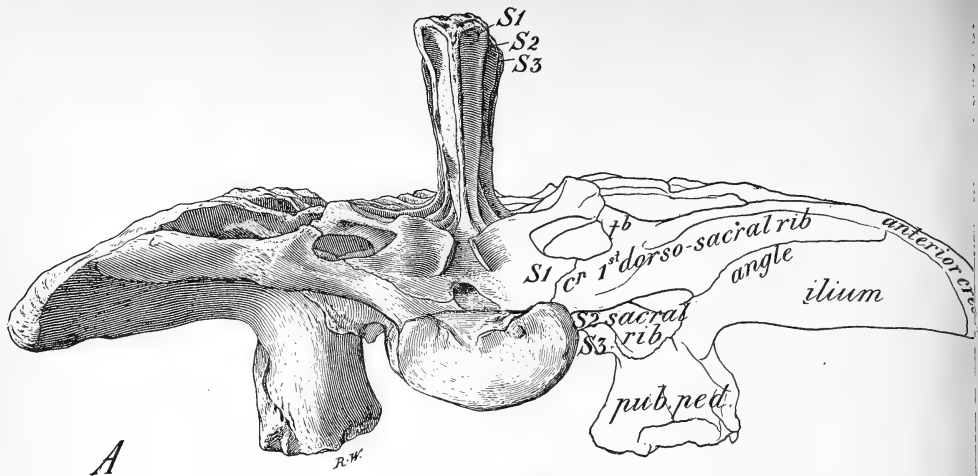


Fig. 4, A, B, C. Anterior, posterior, and left lateral views of the sacrum and ilium of *Brontosaurus* sp. No. 675, Amer. Mus.  $\times \frac{1}{12}$ . [188]

ferior spur to rib of *S. 2*. *S. 2*, second dorso-sacral, spine and centrum coalesced with those of first primary sacral; relatively narrow rib uniting laterally with peduncle of ilium and anterior border of sacral plate, rising above to crest of ilium in a thin diapophysial plate. *S. 3-5*, three primary sacrals constituting main portion of sacral plate with coalesced neural spines, ribs expanding into diapophysial plates above; *S. 3* with broad sacral rib entering sacral plate and acetabulum; *S. 4* with a short centrum and narrower sacral rib sharply ridged below, also entering acetabulum; *S. 5*, unusually long centrum with broad rib (which does not enter acetabulum) uniting with ischiadic peduncle. *S. 6*, caudo-sacral, with a broad sacral rib uniting with posterior portion of sacral plate and ischiadic peduncle, with diapophysial plate uniting with posterior crest of ilium.

The inferior view of these vertebræ corresponds in character with Marsh's figures of *Brontosaurus excelsus* and of *B. amplius*.

These descriptions and figures bring out very clearly the fundamental resemblances and differences between the sacra of *Morosaurus*, the simplest type, *Diplodocus*, an intermediate type, and *Brontosaurus*, the most specialized type.

### 3. COALESCENCE OF CAUDALS.

(Fig. 5.)

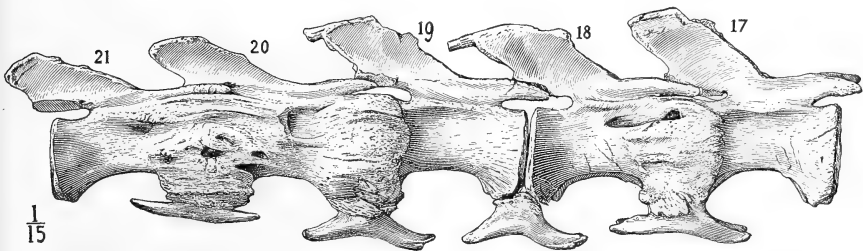


Fig. 5. Caudals 17-21, right side of *Diplodocus longus*. No. 655, Amer. Mus.  $\times \frac{1}{15}$ .

As observed by Osborn and Hatcher in *Diplodocus*, the chevrons and centra of the caudals between 16 and 18 tend to coalesce, indicating apparently a fixed or resting point in the tail. In the large individual (No. 655, Amer. Mus.) caudals

Nos. 17 (?), 18 (?), and 19-21 (?) are coalesced with each other and with their respective chevrons; there is also more or less lateral exostosis at the joints.

No indication of such coalescence is thus far recorded in the caudals of *Brontosaurus* and *Morosaurus*. A specimen of the

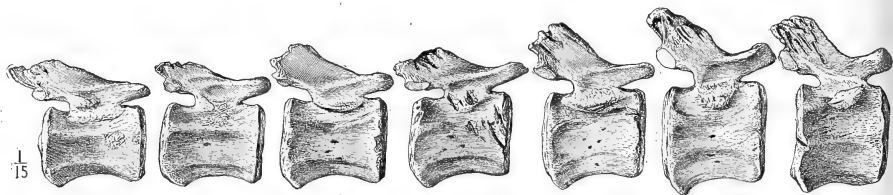


Fig. 6. Caudals 14 (?)–20 (?) of *Brontosaurus* sp. No. 222, Amer. Mus.  $\times \frac{1}{15}$ .

tail of *Brontosaurus* in the same region is interesting as showing the freedom of the short vertebræ and the grooves on the neural spines and centra caused by the teeth of carnivorous dinosaurs.

#### 4. SMALL TERMINAL CAUDALS.

Small terminal caudals have already been described by Osborn in *Diplodocus*. A specimen of *Brontosaurus* shows that the tail terminates in at least five rod-like caudals.

## Article XV. — PROPER GENERIC NAMES OF MIOCENE HORSES.

By J. W. GIDLEY.

In making an exhaustive study of the Miocene horses of America it became evident to the writer that most of the genera as well as many of the species have never been clearly defined. The genera proposed by Leidy seem especially confused and have apparently been wrongly understood by later authors.

The object of the present article is to define briefly these genera and place them in their apparently proper relations, leaving a fuller discussion for a later publication.

They are taken up in chronological order, as follows:

### **Hipparion** *Christol.*

This genus, as has been shown in a former publication,<sup>1</sup> is confined, so far as is known, entirely to the Old World, the American forms possessing long-crowned teeth with free or isolated protocones having been wrongly referred to this genus. Such American forms have been referred to a distinct genus, *Neohipparion*.<sup>1</sup>

### **Merychippus** *Leidy.*

Leidy unfortunately had only teeth of the upper deciduous series on which to base this genus. However, numerous specimens in the American Museum collection, some of them jaws with short, hypsodont, well-cemented permanent molars still possessing lightly cemented, brachyodont milk molars, prove that this genus was well founded and is not, as suggested by Cope, synonymous with *Protohippus*, in which the deciduous molars as well as the permanent series are hypsodont and strongly cemented.

### **Hyphippus** *Leidy.*

A single upper deciduous molar was taken as the type of this genus. This tooth was later considered by Cope<sup>2</sup> as

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<sup>1</sup> Bull. Am. Mus. Nat. Hist., Vol. XIX, 1903, pp. 465-479.

<sup>2</sup> Fourth Ann. Rep. Texas Geol. Surv., 1892 (1893), p. 20.

representing the temporary dentition of a species of *Protohippus*. But several adult specimens taken from the Miocene beds, show clearly that the permanent as well as the deciduous dentition of this genus has simple, brachyodont, uncemented teeth. Cope's supposition therefore was erroneous and the genus is now well founded.

*Anchitherium equinum* Scott, which possesses teeth of the same general character as Leidy's type, should undoubtedly be referred to this genus.

### **Parahippus Leidy.**

Again, deciduous teeth were taken by Leidy for the type of a genus, and here, again, Cope erroneously held that the specimen represented the temporary dentition of a species of *Protohippus*.<sup>1</sup>

*Parahippus* was based on a series of three upper milk molars which, as proved by a comparison with adult specimens of like general structure, belong to a genus having, in common with *Hypohippus*, brachyodont teeth in both the deciduous and permanent series, but differing essentially from that genus in the crown structure of the teeth.

In *Parahippus* the external walls of the metacone and paracone are strongly ribbed in the milk series. The crochet, which by uniting with the protoconule completes the boundary of the prefossette, thus forming a most important part in the more advanced types of horses' teeth, is wanting in *Hypohippus*, but is strongly developed in both the deciduous and permanent series of *Parahippus*. In the lower teeth the metaconid and metastylid are much more strongly divided than in *Hypohippus*.

*Desmatippus crenidens* Scott, and *Anchippus brevidens* Marsh, which are apparently synonymous species, as well as *Anchippus texanus* Leidy, almost certainly belong to the genus *Parahippus*.

### **Protohippus Leidy.**

This classical genus was founded on a series of four upper teeth (p<sup>4</sup> to m<sup>3</sup>) in a fragment of the maxillary.

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<sup>1</sup> Fourth Ann. Rep. Texas Geol. Surv., 1892 (1893), pp. 20, 23.

Though many species of other genera have wrongly been referred to this genus it can now be clearly defined. Its chief distinctions are its moderately long-crowned, greatly curved hypsodont teeth, in which the protocone and protoconule are strongly united to near their summit in the unworn tooth, and in which the enamel foldings of the cement lakes or fossettes are comparatively simple. The teeth of the temporary series are hypsodont and heavily cemented. Cope wrongly referred some species of this genus to *Hippidium*, an exclusively South American genus.

*Anchippus* Leidy.

*Anchippus* was founded on a single upper molar of the permanent series and, as above stated, is undoubtedly referable to the genus *Parahippus*.

*Pliohippus* Marsh.

Marsh established this genus primarily on the absence of lateral toes and the reduction of metapodials II and IV to splints, as in the genus *Equus*. However, a careful examination has convinced the writer that the type does not prove this character, which is, to say the least, a rather doubtful one. The lateral metapodials of the type specimen are much reduced distally, but in every case they present fractured ends, showing that they are not complete and may have ended distally in the ordinary laterally compressed facet bearing a vestigial toe. In the American Museum collection are examples of complete metapodials in which the distal portion of the shaft is almost as much reduced as in Marsh's type.

The teeth are in general much like those of *Protohippus*, except that there is an apparent tendency to a more or less complete union of the protocone and hypocone. The protocone is united with the protoconule as in *Protohippus*.

At present, therefore, there are apparently no well-defined characters by which this genus may be distinguished from *Protohippus*.

*Desmatippus* Scott.

As at present understood this genus is undistinguishable from *Parahippus* Leidy.

[May, 1904.]

## SUMMARY.

The chief distinguishing characters of the American Miocene genera as now understood may be given briefly as follows:

*Hypohippus*.—Both deciduous and permanent series of teeth brachyodont, no cement; both upper series without external ribs on paracone and metacone; metaloph simple and undivided, but strongly united with the ectoloph; no crochet; metaconid and metastylid of lower teeth undivided or slightly divided by a shallow notch at the summit of an unworn tooth.

*Parahippus*.—Both deciduous and permanent series of teeth brachyodont, deciduous series without cement, permanent series sometimes lightly cemented; deciduous upper molars with prominent external ribs on paracone and metacone; metaloph strongly united with ectoloph; crochet well developed, uniting more or less strongly with the protoconule; metastylid strongly developed, with well-marked groove separating it from the metaconid.

*Merychippus*.—Deciduous molars brachyodont with little or no cement; permanent series short hypsodont, fully cemented.

*Protohippus*.—Both deciduous and permanent series of teeth hypsodont and strongly cemented; permanent series moderately long-crowned; crowns much curved; protocone and protoconule strongly united; fossettes or cement lakes wide transversely with open loops, and usually with comparatively simple enamel borders.

*Neohipparion*.—Both deciduous and permanent series of teeth hypsodont and strongly cemented; teeth of permanent series usually longer crowned and upper teeth less curved than in *Protohippus*; protocone free to near its base as in *Hipparion*.







A GRAVE IN A KNOLL SURROUNDED BY 'SCAB LAND' NEAR TAMPICO, WASHINGTON. THE HILL TO THE RIGHT MARKS  
THE WESTERN END OF THE DESERT AND THE BEGINNING OF THE TIMBERED LAND.  
AMER. MUS. NEG. CAT. NO. 5-10.

**Article XVI.**—A COSTUMED HUMAN FIGURE FROM  
TAMPICO, WASHINGTON.

By HARLAN I. SMITH.

PLATES VI-IX.

The following is a description of a remarkable specimen (Fig. 1; Cat. No.  $\frac{202}{8191}$ ) secured June 16, 1903, by the writer while making an archaeological reconnoissance of the Yakima Valley for the American Museum of Natural History. It is made of antler, is 247 mm. long, from 2 to 5 mm. thick, and is engraved on one surface to represent a human figure in costume. This specimen was found in the grave of a child about six years old, which was situated near Tampico, in the Atanum Valley, Yakima County, Washington. The place is about eighteen miles west of old Yakima.

In this arid region are stretches of country locally known as 'scab land,' on which are occasionally groups of low dome-shaped knolls from about 50 to 100 feet in diameter by 3 to 6 feet in height. These knolls consist of fine volcanic ash, and apparently have been heaped together by the wind. This ashy material has been swept from the intervening surface, leaving the 'scab land' paved with fragments of basalt imbedded in a hard soil. The prehistoric Indians of this region have used many of these knolls, each as a site for a single grave. These graves, which are located in the tops of the knolls, are usually marked by large river pebbles, or, in some cases, by fragments of basalt, that appear as a circular pavement projecting slightly above the surface of the soil. (See Plate VI.)

The particular grave in which this specimen was found was indicated by irregular and jagged basaltic rocks which formed a pile, about 8 feet in diameter, on top of an ash dome, located on the bottomland about 600 feet north of the Atanum River, and about 15 feet above the water-level. It lay immediately to the northeast of and in the angle formed by the junction of the east and west road with the one from the

north, and directly across to the east from the farm of Mr. Sherman Eglin.

These jagged rocks and the soil which had accumulated between them extended down to a depth of 3 feet from the surface, where a box or cist was found, which was formed of thin slabs of basaltic rock about 2 feet long by  $1\frac{1}{2}$  feet wide, and from  $1\frac{1}{2}$  to 2 inches thick, with thin, sharp edges. These had been placed on edge,—several to form the sides and one or two to form the ends. The cist thus made was covered with two large flat slabs which projected beyond the sides of the box. (Plate VII, Fig. 1.) There were no slabs or other rocks forming the floor to the cist, which was filled with soil that had worked in between the stones.

This was the only grave in which we found a stone cist, the other graves being more or less filled, from the skeleton to the surface, with irregular rocks or pebbles.

This cist may be perhaps best described by stating that it resembled very much the stone graves of Kentucky and Ohio, excepting that limestone was not here used and that the position of the skeleton and the character of the objects found within were not similar to those usually observed in the stone graves of the Mississippi Valley. It is also to be noted that here we have a pile of jagged rocks over the cist, as is seldom the case in the East.

Within the box and about on a level with the lower edges of the enclosing slabs was the skeleton (Cat. No.  $\frac{202}{4321}$ ) of the child. (Plate VII, Fig. 2.) It lay upon the left side, the head towards the west, facing north, and with the knees flexed close to the chest. The skull is slightly deformed by occipital pressure. Under the body, scattered from the neck to the pelvis, were found eighteen dentalium shells (Cat. No.  $\frac{202}{8192}$ ). Ten of these were ornamented with engraved designs (Cat. No.  $\frac{202}{8193}$ ), and resembled the engraved dentalium shells found in the Thompson River region. A small piece of bone (Cat. No.  $\frac{202}{8194}$ ) and some charcoal (Cat. No.  $\frac{202}{8195}$ ) were also found in this grave.

The grave and the specimens that were found in it seem to antedate the advent of the white race in this region, or at



FIG. 1.

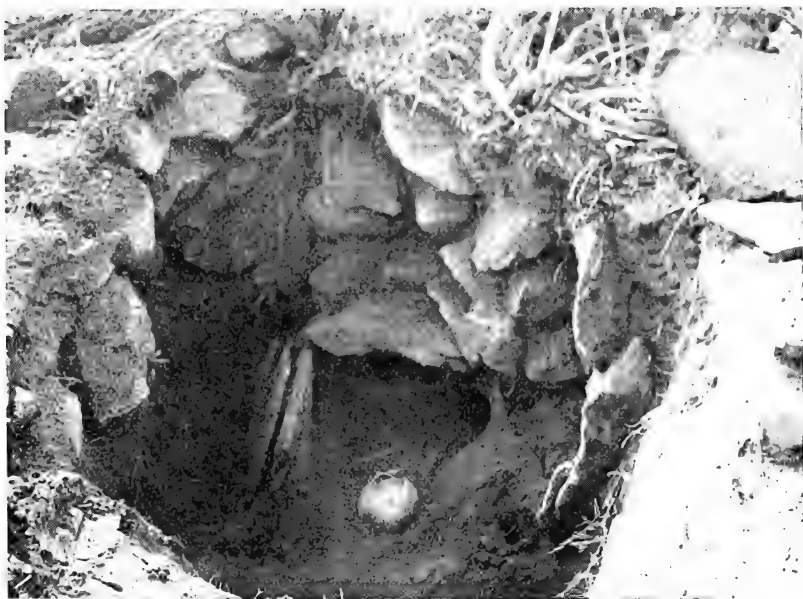


FIG. 2.

GRAVE IN WHICH TAMPICO SPECIMEN WAS FOUND.

Fig. 1. Stone cist in opened grave. Amer. Mus. Neg. Cat. No. 5-11. Fig. 2. Skeleton of child in opened cist. Amer. Mus. Neg. Cat. No. 5-12.



least to show no European influence. On the other hand, there was no positive evidence of their great antiquity.

The antler figure lay horizontally under the vertebræ of the child, with the engraved surface up. As the costume is apparently a man's, it would seem that the child had been of that sex. An ear-shaped projection may be noted on each side of the head-dress, too far from the head to indicate the ears, which apparently are omitted. These projections are perforated with two holes, and were probably intended to fasten the figure to something or as places of attachment for decorative or symbolic objects, such as feathers. There are two perforations in the middle of the face, which, while they may have been similarly used, possibly indicate the nostrils, although they seem to be higher up than the tip of the nose. Below the nose are faint suggestions of an ornament. The eyes are of the shape of a parallelogram with rounded corners. These, with similarly shaped figures on the head-dress or inner hair-rolls, and on the hands, knees, and insteps, slightly resemble a motive common in the art of the coast to the northwest. The crescent-shaped mouth and thick lips are indicated by incised lines, while the cheeks are full, and the entire head is somewhat set out in relief from the rest of the object. At each side of the head are two surfaces which appear to represent part of the head-dress or the hair done up in great rolls, the two inner being the largest. These surfaces

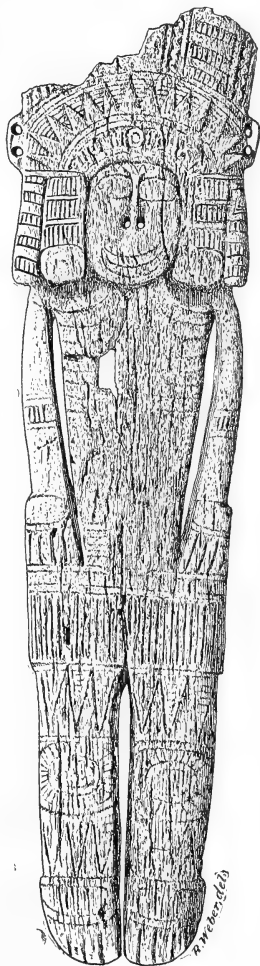


Fig. 1. Figure made of Antler. From a child's grave near Tampico, Washington. Amer. Mus. Cat. No. 5191.  $\frac{1}{2}$  nat. size.

are marked by horizontal bands, the alternating ones being filled with vertical hachure. These bands may represent the lines of attachment of additional hair, by means of glue covered with lime. The hair is dressed in this manner by Plains tribes.

Above the face is a zigzag line which may represent tattooing, painting, or a head-ring. The zigzag is a common form of decoration on the head-bands of the Sioux. Above the head, arranged in a semicircular row, are certain oblong forms which may indicate feathers. The middle form in this row, however, is marked with a circle. At both the bottom and top of this row are three incised lines forming an arc. Based on the outer one of these incisions are isosceles triangles slightly in relief. These do not represent feathers in a realistic way, but closely resemble the conventional paintings made by the Sioux on buffalo robes. These paintings have been called sun symbols, but are interpreted by the Sioux as the feathers of a war bonnet or other head-dress. If these triangles represent the feathers of the head-dress, they are certainly in the correct position. Between them are incised arcs forming hachure parallel to the arcs previously mentioned. Two of these extend above the tips of the triangles. Beyond this, much of the object is missing, but to the right may be seen a surface similar to the areas interpreted as hair-rolls. This extends up from the arcs which are beyond the line of the triangle points, and on both sides of it is carved a figure consisting of two vertical bars in relief with a zigzag bar between them. There are indications of a similar figure at the left.

The two ridges, extending from near the chin to the shoulders, seem to indicate collar bones. The body is thin and narrows downward. Paintings or tattooings, representing the ribs, or the ribs themselves, are indicated by ridges. There is horizontal hachure on the body above the waist. The arms are separated from the body by incisions made from both the front and the back, and the outer edges of the object, being rounded off, are like portions of a carving. A bracelet, band, or figure painted or tattooed, on the apparently bare arm is



indicated in the middle of each by vertical hachure connecting pairs of parallel lines. At the wrist is a slight horizontal incision, where the hand expands somewhat sidewise. The fingers and thumb, separated by four vertical incisions, are set off from the palm by two lines, which, with the mark at the wrist, make a figure resembling the eye-form so common in Northwest Coast art. Below these and extending across the body are four horizontal lines, the space between the two in the middle being slightly wider than the other two spaces. These lines seem to indicate the upper edge of an apron, which is covered by vertical hachure.

The legs begin at the bottom of the apron from which they are set off by two horizontal incisions. The apron at the outline of the object projects slightly beyond them. On each leg are five incised isosceles triangles,—three at the top and two at the bottom, with their long points extending towards the knees. At each side of the lower triangles is one line which seems to represent a continuation of the designs around the legs. On each triangle is horizontal hachure. On both knees are faint traces of two concentric incisions, forming squares with rounded corners and bulging sides. Between these is a radiating hachure. Close inside is a concentric incised line, and there may be seen two parallel lines, nearly horizontal, above the right knee and one below it, and one above the left knee.

The triangles may be considered as pointing from these concentric designs rather than towards them, and in that case the lines, suggesting the continuation of the design around the leg, appear at the top instead of the bottom. It does not seem probable that these triangles represent part of a circular design radiating from the knees, the sides of which are folded around the legs, but rather that the two series of triangles extend horizontally around the legs.

The incisions on the legs probably represent painting or tattooing, since the designs seem to be horizontal and to extend all around the legs, while on leggings the patterns are usually vertical and on a flap at the outer side of the leg, the knee being disregarded. Catlin (O-kee-pa, Plates V and VI) figures

paintings on the arms and legs of the Mandans similar to the patterns on this carving. The custom is not rare, especially in connection with elaborate ceremonial costumes such as are represented by this figure. The concentric design probably is related to the wheel, sun, or spider-web pattern common as a symbol on the shirts, blankets, and tents of the Plains tribes.

The feet jutting out at the sides are slightly wider than the legs. The inside of the foot is straight with the inside of the leg, while the outer part is curved. The two, taken together with the lower portion of the legs, resemble a divided hoof. The divided hoof is a common design among Plains tribes. The vertical incisions on the feet probably represent the toes, or designs painted or tattooed on the feet. These lines argue against any idea that the feet are encased in moccasins, unless bead or quill work on or improbable wrinkles in the moccasins are indicated by them. The reverse of the object is plain.

The Indians of this region have painted with red and white on the basaltic cliffs in various parts of the Yakima Valley. Many of these paintings represent human heads, and some of them the whole figure. All of these are represented with a feather head-dress. Those shown in Plate VIII are on the south side of the Natches River at the west of the mouth of Cowiche Creek and only fourteen miles from Tampico.

Similar heads and figures, each with a feather head-dress, are represented by lines pecked into the surface of the basaltic columns on the eastern side of the Columbia River at Sentinel Bluffs. These are only 47 miles from Tampico, and are shown in Plate IX.

In general the shape of both the painted and pecked full figures resembles that of this specimen and the one shown in Fig. 3.

There are only two specimens, of which I am aware, that resemble this. One (Cat. No. <sup>T</sup>~~22107~~ [177 H]) consists of seven fragments of a thin piece of antler found by Mrs. James Terry at Umatilla, Oregon, only about 83 miles in a southerly direction from Tampico. The back of this specimen is largely disintegrated, except on the two dog heads, and these being only about 5 mm. thick suggest that the whole figure was thin. The carving (Fig. 2) is in much greater relief than in the specimen



FIG. 1.



FIG. 2.

PAINTINGS ON BASALTIC CLIFFS AT THE WEST OF THE MOUTH OF COWICHE  
CREEK, WASHINGTON.

Fig. 1. White representations of human heads with feather head-dresses. Amer. Mus. Neg. Cat. No. 4-8. Fig. 2. Red representation of a human figure with feather head-dress. Amer. Mus. Neg. Cat. No. 4-4.



from Tampico, although some of the lines are merely incisions. The tongue projects between, but not beyond, the lips. The cheeks are raised and there is considerable character to the face. The nose is aquiline and narrow, but the alæ are indicated. The orbits are sunken and horizontal oblong pits evidently indicate the eyes. The eyebrows are raised. Two horizontal incisions extend across the brow. Below the chin, at the left, are four incisions in a raised piece. This seems to represent a hand held with the fingers to the neck. A similar hand was probably at the right. A foot, with four toes in relief projecting above the brow as



Fig. 2. Fragments of a figure made of Antler. From Umatilla, Oregon, collected by Mrs. James Terry. Amer. Mus. Cat. No.  $\frac{50}{110}$  T 22187 (177H).  $\frac{1}{2}$  nat. size.

high as do the eyebrows, rests immediately above the upper horizontal incision and apparently indicates that some animal, possibly a bird, stood upon the human head. The fragment, however, is not sufficiently large to settle these points. Two of the other fragments are apparently intended to represent the heads of dogs. The eyes are indicated by the common circle and dot design; while the nostrils in one are represented by drilled dots. The shape of the heads is brought out by the carving of the edge of the object. The fragments are broken off at the neck, and the lower side of each shows the finished surface of the back of the object. The remaining fragments show little or nothing. The animal heads and the feet and hands suggest the possibility that in some cases animal forms were combined with such figures, as on the Northwest Coast, although the general style of art of the object is not like Haida or Kwakiutl work, but more like the carvings of Puget Sound and the lower Columbia River. The fact that the carving of this face is more in relief helps to explain the intent of the author of the Tampico specimen.

The other specimen (Cat. No.  $\frac{50}{110}$  A, B, C) is a quill-flattener, made of antler (Fig. 3). It was obtained by Dr. Clark Wissler

from the Dakota at Pine Ridge, South Dakota, who also made reference to other objects of the same sort among the tribe. Porcupine quills were flattened on it with the thumb-nail until after it had been broken, when the lower or pointed end had been used as a brush in applying color to

form designs on various articles made of buckskin. This end is stained a deep red and the point is much worn. The object in general resembles in shape and size the specimen from Tampico. Its sides are somewhat thinner and sharper. The slight indications of the hair or head-dress, the deeply cut eyes and mouth in the concave side, the holes or ears at the sides of the head, and the method of indicating the arms by slits, setting them off from the body, are all details which emphasize this general resemblance. The technical work is about as good as that of the Tampico specimen, but the art work is inferior. One edge of the

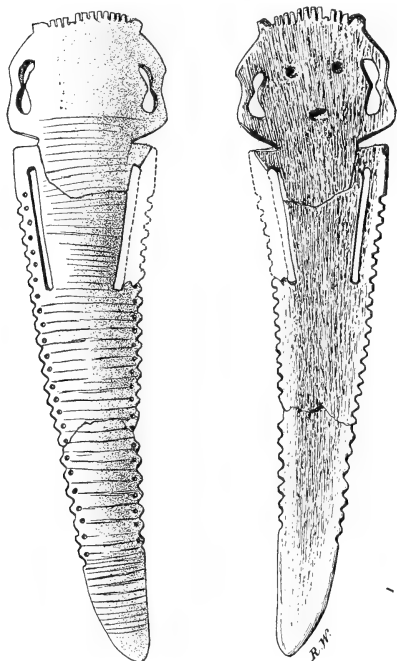


Fig. 3. Quill-flattener made of Antler. From the Dakota at Pine Ridge, South Dakota, collected by Dr. Clark Wissler. Amer. Mus. Cat. No. 3110 A, B, C.  $\frac{1}{4}$  nat. size.

convex or outer surface of the bone has twenty-five notches, and in each tooth left between them, as well as above the top one, is a small drilled dot. Some of the notches on the other side are broken away with the arm, which is missing. On the same surface are twenty-six horizontal incisions, which were interpreted as year counts. The general shape of the body and the rows of dots are similar to those of the figure pecked on the cliff at Sentinel Bluffs. (See Plate IX, Fig. 1.)





FIG. 1.

PICTURES, SOME OF THEM REPRESENTING HUMAN HEADS AND WHOLE FIGURES, EACH WITH A FEATHER HEAD-DRESS, PECKED  
IN BASALTIC COLUMNS AT SENTINEL BLUFFS, WASHINGTON.

Fig. 1. Amer. Mus. Neg. Cat. No. 8-o.



FIG. 2.

Fig. 2. Amer. Mus. Neg. Cat. No. 8-11.



The Tampico specimen may have developed from a quill-flattener, which implement was probably of common and characteristic use among Indian mothers, not only of the plains but also as far west as Tampico. If the result of such a development it had probably lost its domestic use and become entirely symbolic.

The head-dress seems to be a so-called war-bonnet, and would indicate that the figure was that of an important personage; perhaps a suggestion of what had been hoped for the child's position in the tribe or after death. The arms, body, legs, and feet are apparently bare and ornamented with ceremonial paintings, while about the waist is an apron. The whole object seems of a rather high order of art to be a mere child's doll, and it would seem more plausible to consider it as an emblematical figure. The general style of art and costume indicated show little or no resemblance to those of the Northwest Coast, but a strong relationship to those of the Plains.



**Article XVII. — FURTHER NOTES ON MAMMALS FROM  
NORTHWESTERN DURANGO.**

By J. A. ALLEN.

Since my previous report on mammals collected by Mr. J. H. Batty in northwestern Durango (see this Bulletin, XIX, 1903, pp. 590-612), additional specimens have been received from him, from the same general region, representing additional localities and six additional species. The later shipments raise the total number of specimens received from this limited area (*cf.* l. c., pp. 590, 591) to about 660, and the number of species to 40. Considering the comparatively small area traversed, and the arid nature of the country, this large number of species indicates a quite varied fauna, and shows that Mr. Batty made a thorough exploration of this small tract of country, limited to the Sierra Madre and adjoining plains to the eastward.

The new localities represented by the present material are San Andres, Guanacevi, La Cienega, Cienega Corrales, and La Boca, ranging in altitude from 3000 to 8000 feet. The species additional to the previous list are indicated by an asterisk prefixed to the name.

1. *Odocoileus battyi* Allen.—Four specimens, skins and skulls, and 2 additional skulls, Guanacevi, September.

2. *Sciurus apache* Allen.—Three specimens, collected as follows: San Andres (alt. 3000 ft.), 1, Oct. 15; Cienega Corrales (alt. 7000 ft.), 2, Nov. 9 and 11. These are much darker than May specimens, with the fulvous of the underparts deeper, and the tail fringed with deep fulvous instead of pale fulvous or yellowish white, as in late May specimens from the same general locality.

\* 3. *Sciurus aberti phæurus*, subsp. nov.

Type, No. 23821, ♀ ad., La Cienega (alt. 7500 ft.), northwestern Durango, Mexico, Nov. 4, 1903; coll. J. H. Batty.

Similar to *S. aberti durangi*, but with the back gray, faintly suffused

with reddish, chiefly below the surface and only slightly visible, instead of dark rufous or reddish chestnut along the back from shoulders to rump, as in typical *durangi*; sides of nose (to eyes) gray, in some specimens faintly tinged with pale buff, not "dingy gray suffused with brownish but usually reddish brown," as in *durangi*; eyering soiled white; base of ears externally pale reddish brown; a prominent black lateral line; tail gray above and below, more finely grizzled below, broadly fringed with white, exactly as in *durangi*.

*Measurements.*—Type: Total length, 493 mm.; head and body, 271; tail vertebræ, 222; hind foot, 69. A series of 11 adults measure: Total length, 477 (453–508); tail vertebræ, 216 (203–229). These measurements are considerably below those given for *S. durangi* by Mr. Nelson (Proc. Washington Acad. Sci., I, 1899, p. 86).

This subspecies is based on 12 specimens collected at La Cienega (alt. 7000 ft.) and Cienega Corrales (alt. 7000 ft.), Nov. 1–13, and hence in fall pelage, with the ear-tufts only slightly developed. The series is very uniform in coloration. The faint reddish suffusion of the back is mostly hidden below the surface, giving the effect of dull gray with a faint reddish cast, scarcely noticeable except on close inspection. A single specimen forms an exception, having the whole middorsal region strongly reddish, but much less red than typical *durangi*.

*Sciurus aberti phæurus* differs from *S. aberti durangi* mainly in the absence of the reddish brown dorsal area and in smaller size. As regards coloration, it is almost the exact counterpart of *S. aberti ferreus* of True (described originally as *S. a. concolor*) from northeastern Colorado, the most distant point from Durango in the range of the *Sciurus aberti* group.

Since writing the above I have had an opportunity, through the kindness of Dr. C. Hart Merriam, Chief of the Biological Survey, to examine the fine series of *Sciurus durangi* collected by Messrs. E. W. Nelson and E. A. Goldman, comprising a series of 24 specimens, all practically topotypes of the species. These are all red-backed, in striking contrast with the form here named *phæurus*. Seven specimens in the same collection from Guadalupe y Calvo, Sonora, are variously intermediate between *aberti*, *durangi*, and *phæurus*; three of them are dis-

tinctly intermediate between *durangi* and *aberti*, being similar to *aberti* but with much less white in the tail; two others closely approach *phæurus*, having the back gray and the tail as in *durangi*; the other two are fairly intermediate between *durangi* and *phæurus*.

An allied and apparently rather unstable form occurs at Colonia Garcia, in northwestern Chihuahua, and may be thus described:

***Sciurus aberti barberi*, subsp. nov.**

Type, No. 17503, Am. Mus. Nat. Hist., ♀ ad., Colonia Garcia, Chihuahua, Oct. 14, 1901; coll. C. M. Barber, for whom the subspecies is named.

Similar to *S. a. phæurus*, except that the lower surface of the tail is white instead of finely grizzled gray, as in *durangi* and *phæurus*.

*Fall pelage*.—Sides of nose and eyering soiled white; general color above clear gray, with a subapical pale fulvous suffusion not usually visible except on parting the hairs; a broad black lateral line; ventral surface white; upper surface of fore and hind feet white; tail above mixed black and white, very broadly fringed with white, and white below, except at extreme base, as in *S. aberti*; ears nearly naked, slightly rufous at base outside, with the black ear-tufts about half grown.

*Measurements*.—Type: Total length, 500 mm.; tail vertebræ, 240; hind foot, 70. Six adult specimens, all from the type locality, measure: Total length, 507 (500–516); tail vertebræ, 237 (220–250); hind foot, 71.9 (70–72).

In the worn summer pelage (May 26–June 18) the gray of the upper parts is duller and more dingy, and the feet are gray instead of white; two specimens out of five show slight traces of red along the middle of the back.

This form is closely related to true *aberti*, it considerably exceeding in size either *durangi* or *phæurus*, from both of which it differs in having the under surface of the tail heavily washed with white, so that the gray basal portion of the hairs is thinly overlaid by white, while in *aberti* the hairs of the lower surface of the tail present a solid mass of white, the hairs of the whole lower surface being pure white to the base.

The above description was originally based on a series of 7 specimens with wholly gray backs, or with only a slight

suffusion of reddish brown, they agreeing in this respect with typical *phæurus*, but the lower surface of the tail is lightly washed with white instead of being wholly grizzled gray. I have since had the pleasure of examining a series of 22 specimens in the collection of the Biological Survey, from Colonia Garcia and vicinity, of which about half have the dorsal region gray, while most of the others have the reddish brown dorsal area common to true *S. aberti* and *S. aberti durangi*; all, however, have the under surface of the tail superficially white — not solidly white as in true *aberti*. The red-backed specimens are strikingly similar to the Sonoran red-backed Guadalupe y Calvo specimens noted above under *S. a. phæurus* as intergrades between *S. aberti* and *S. a. durangi*, and perhaps they should be considered as intergrades between the form here described as *barberi* and *aberti*. The color of the feet varies with season in probably all the forms of the *aberti* group, being gray in summer and white in winter, but the amount of white on the feet is to some extent correlated with the color of the under surface of the tail.

*Sciurus aberti* forms a curiously variable group, with somewhat parallel lines of variation in widely separated localities, the intermediate regions being occupied by other and very different forms, as illustrated by the distribution of *S. a. ferreus* and *S. a. phæurus*, in comparison with that of true *aberti*.

\* 4. ***Eutamias canescens***, sp. nov.

Type, No. 23852, Am. Mus. Nat. Hist., ♀ ad., Guanacevi (alt. 8000 ft.), Durango, Mexico, Oct. 12, 1903; coll. J. H. Batty.

Similar in general appearance to *E. dorsalis*, but with the dorsal stripes much more strongly defined. General color above gray, suffused with fulvous, the tips of the hairs being whitish with a subapical zone of yellowish, which more or less tinges the surface; median dorsal stripe narrow, deep black, extending from middle of crown to base of tail; the two lateral dark dorsal stripes short, mixed fulvous, gray and black, the black sometimes predominating but usually obscured by the gray and fulvous; inner pair of light stripes ashy gray, the outer lighter, whitish gray; sides pale rusty fulvous, much brighter than in *E. dorsalis*; tail as in *dorsalis*,—above mixed gray and black, sides fringed with whitish gray, lower surface with the central area and

anal region deep orange rufous; head stripes and ears as in *dorsalis* but the dark stripes are stronger, the white stripes clearer white, and the post-auricular white patch larger and more conspicuous.

*Measurements.*—Type: Total length, 254 mm.; head and body, 140; tail vertebrae, 114; hind foot, 35; ear from crown, 16; ear from notch, 19.5. *Skull*, total length, 38; zygomatic breadth, 20. Three other specimens have practically the same measurements as the type, and two others (young adults) are somewhat smaller.

Based on 9 specimens, all collected at Guanacevi, Oct. 8–17.

*Eutamias canescens* belongs distinctly to the *E. dorsalis* group, but differs from true *dorsalis* in the greater distinctness of the dorsal stripes and the deeper fulvous of the sides. Two specimens from Colonia Garcia, Chihuahua, collected Oct. 12, and thus strictly comparable as to season, closely agree with the Durango series. This is apparently the first record of the *E. dorsalis* group in Mexico. Two very distinct species of *Eutamias* — *durangæ* and *canescens* — thus occur in the mountain ranges of northwestern Durango.

5. ***Citellus grammurus rupestris* Allen.** Nine specimens, 6 adult and 3 young, Guanacevi, Oct. 8–17. Two of the adults are still partly in the discolored, greatly worn pelage of summer; the other four adults have moulted into fall pelage. The young are less than one quarter grown, showing that the young are sometimes born as late as the latter part of September. As the April and May series contained no young, and no females that were nursing young when killed, the breeding season does not begin apparently till June and continues till late in September.

\* 6. ***Citellus spilosoma* (Bennett).** Three specimens, an adult female and two young in first pelage, Rio Ocampo, June 30.

7. ***Mus alexandrinus* Geoffroy.** Two specimens, San Andres, Oct. 15.

8. ***Mus musculus* Linn.** Two specimens, Guanacevi, Oct. 19.

9. ***Sigmodon minimus* Mearns.** One specimen, Guanacevi, Oct. 12.

10. ***Sigmodon baileyi* Allen.** One specimen, Guanacevi, Sept. 21.

11. ***Thomomys sinaloæ* Merriam.** One specimen, La Boca (alt. 8000 ft.), Oct. 15.

12. ***Lepus gaillardi battyi* Allen.** Three adults and one young in first pelage, Rio Ocampo, June 29 and 30.

13. ***Lepus arizonæ major* Mearns.** Three specimens — one young in first pelage, Rio Ocampo, June 30; two adults, Guanacevi, Oct. 6 and 13.

Mr. E. W. Nelson has kindly called my attention to the fact that my *Lepus durangæ* (this Bulletin, XIX, 1904, p. 609) is the same as *Lepus holtzneri* Mearns, a species I entirely overlooked when describing *L. durangæ*.

\* 14. ***Urocyon cinereoargenteus scotti* (Mearns).** Two specimens, Rosario, Jan. 21; Rio Ocampo, June.

\* 15. ***Ursus americanus* Pallas.** One specimen, skull only, Rio Ocampo.

16. ***Myotis californicus durangæ* Allen.** One specimen, Rio Ocampo, June.

17. ***Antrozous pallidus* (Leconte).** One specimen, Rio Ocampo, June.



Article XVIII. — NOTICE OF TWO NEW OLIGOCENE  
CAMELS.

By W. D. MATTHEW.

***Pseudolabis dakotensis*, gen. et sp. nov.**

*Char. gen.*—Dentition  $I^3_2$ ,  $C^1_7$ ,  $P^4_7$ ,  $M^3_7$ .  $I^{1-2}$  large.  $I^3$ ,  $c^1$ , and  $p^1$  caniniform.  $P^4$  with double internal crescent. Molars without mesostyle.

*Char. spec.* — Larger than any species of *Poebrotherium*, molars as hypsodont as in that genus, resembling them except in size and in absence of mesostyle.  $P^2$  unreduced, without internal cingulum.  $P^3$  with strong, complete internal cingulum.  $P^4$  with two distinct internal crescents, the posterior one sending up a ridge towards the middle part of the external crescent. Skull with large prelachrymal vacuities and a broad circular pit in the maxilla above and a little in front of the infraorbital foramen. Orbits closed behind, the postorbital process of the frontal nearly as much extended as in *Procamelus*. The anterior ends of the frontals are excavated along the median line into a marked depression.

Type, No. 9807, a nearly complete skull, from the Protoceras Beds of South Dakota. Found by J. W. Gidley.

This is the first camel reported from the Protoceras Beds. It is very distinct from any described genus, and clearly off the line of descent of any of the Miocene genera. The molars are like those of *Hypertragulus* in absence of mesostyle; the double internal crescent of  $p^4$  is a unique character, but evidently a special modification from an incomplete internal crescent such as may be seen in  $p^3$  in many artiodactyls. The skull is remarkably modernized for an Oligocene camel, resembling the Middle Miocene types. The genus apparently represents a side line of cameline descent, of which we know nothing further.

***Miolabis (Paratylopus) primævus*, subgen. et sp. nov.**

The type of *Miolabis* is *M. transmontanus* (Cope) of the Mascall formation in Oregon. It differs from *Poebrotherium* in the spacing of the anterior teeth, caniniform  $p^1_1$ , reduction

of  $p^2$ , somewhat more brachyodont molars with prominent external ribs and styles, and much larger size. From *Protolabis* and *Procamelus* it differs in the more brachyodont molars with prominent external ribs and styles, and large  $i^{1-2}$ . From *Protomeryx* it differs in the shorter, less compressed premolars, and probably in the more brachyodont molars.

The species here described comes from the Oreodon Beds of South Dakota, and is of the size of *Poebrotherium*, but otherwise resembles *Miolabis*, except in the reduction of  $p^2$ . This is not a character of more than subgeneric importance, and I cannot discover any more trenchant distinctions, in spite of the wide difference in age. More nearly related to the new species are two camels from the John Day formation, of intermediate age, described by Cope and Wortman under the preoccupied name of *Gomphotherium*.<sup>1</sup> I take the species of the Oreodon Beds as type, because it is the most clearly distinct from the type of *Miolabis*, and because it is represented by a better-preserved and more complete specimen than the John Day species.

The type (No. 9806) is from the Upper Oreodon Beds of South Dakota, and consists of a finely preserved skull and jaws, with the neck, part of the back, and a large part of both fore and hind feet. It was found by J. W. Gidley.

*Char. subgen.* —  $P^2$  unreduced, long and trenchant.

*Char. spec.* — Size of *Poebrotherium labiatum*, but with more elongate muzzle,  $i^3$ ,  $c_1^1$ , and  $p_1^1$  caniniform and spaced. Skull with considerable prelachrymal vacuities, and a shallow depression in maxillaries above and a little in front of infraorbital foramen. Orbits not closed posteriorly. Metapodials like those of *Poebrotherium*, the median pair not united into a cannon-bone, the lateral pair reduced to small nodules in both fore and hind feet. The shaft of the fibula is still present, at least towards its lower end; in *Poebrotherium* the shaft has completely disappeared.

In previous contributions I have provisionally referred *Gomphotherium* Cope to Leidy's genus *Protomeryx*. But *Protomeryx*, as represented by *P. hallii* Leidy and *P. campester*

<sup>1</sup> *Gomphotherium* Cope, 1886, is antedated by *Gomphotherium* Burmeister, 1837, and by *Gomphotherium* Filhol, 1884. See Palmer, Index Generum Mammalium, p. 298.



- I. Undiscovered form with no caniniform teeth.
- II.  $I^3$ ,  $c_1^1$ ,  $p_1^1$ , caniniform, spaced. Limbs of moderate length,  $I^1-2$  large. . . . . *MIOLABIS*.  
 (a.)  $P^2$  unreduced (subgenus *Paratylopus*).  
 1. Small, slender skull. . . . . *M. (P.) primævus*.  
 Upper Oreodon Beds (Mid-Oligocene), S. Dakota.  
 2. Larger, shorter, and heavier skull, broader muzzle.  
*M. (P.) sternbergi*.  
 Diceratherium Beds (Upper Oligocene), Oregon.  
 3. Much larger, skull unknown. . . . . *M. (P.) cameloides*.  
 Promerycochoerus Beds (Lower Miocene), Oregon.  
 (b.)  $P^2$  reduced (subgenus *Miolabis*).  
 4. Size of *M. cameloides*. Muzzle slender.  
*M. transmontanus*.  
 Mascall Beds (Mid-Miocene), Oregon.
- III. Limbs much elongated.  $I^1-2$  reduced. . . . . *OXYDACTYLUS*.  
 (a.)  $P^2$  unreduced. Size large.  
 1. Skull more elongate. . . . . *O. longipes*.  
 2. Skull shorter. . . . . *O. brachyodontus*.  
 Upper Miocene, Nebraska.

#### SERIES B.

Molars progressively higher-crowned, external ribs and styles weak.  
 Fourth premolar simple.

- I. Limbs of moderate length.  $I^1-2$  unreduced.  $P_1^1$  not caniniform. No diastema behind  $c_1$ . . . . . *POËBROTHERIUM*.  
 1. No caniniform teeth, no diastemata. Size small.  
*P. eximium*.  
 Lower Oreodon Beds (Mid-Oligocene), S. Dakota.  
 2.  $C^1$  caniniform,  $p_1$  partly so. A considerable diastema behind  $p_1^1$ . . . . . *P. wilsoni*.  
 Oreodon Beds (Mid-Oligocene), S. Dakota, etc.  
 3. Larger than the preceding,  $p_1$  more truly caniniform.  
*P. labiatum*.  
 Oreodon Beds (Mid-Oligocene), Colorado, etc.
- II.  $P_1$  caniniform. Diastemata behind  $c_1$  and  $p_1$ . . . . . *PROTOMERYX*.  
 1. Size of *Poëbrotherium labiatum*. . . . . *P. campester*.  
 Leptauchenia Beds (Upper Oligocene), Colorado.  
 2. Larger, diastemata shorter. . . . . *P. hallii*.  
 ? Miocene, Nebraska.
- III.  $I^1-2$  more or less reduced. Molars longer-crowned, size larger.  
 Metapodials still separate. . . . . *PROTOLABIS*.  
 Several species, from Middle and Upper Miocene.

IV.  $I^1-^3$  absent. Metapodials united. Limbs of moderate length.

PROCAMELUS.

Several species, from Upper Miocene.

IVa. Limbs and neck greatly elongated. . . . . ALTICAMELUS.

Several species, from Middle and Upper Miocene.

V., etc. Premolars variously reduced.

PLIAUCHENIA, CAMELOPS, ESCHATIUS,	} Pliocene to
CAMELUS, AUCHENIA	

#### SERIES C.

Molars higher-crowned, external ribs weak, mesostyle absent. Fourth premolar with two internal crescents.

I. Unknown.

II. Dentition unreduced.  $I^3$ ,  $c^1$ , and  $p^1$  caniniform, spaced.

PSEUDOLABIS.

Larger than *Poebrotherium*, smaller than Miocene camels.

*P. dakotensis*.

Protoceras Beds (Upper Oligocene), S. Dakota.



## Article XIX. — ON THE RELATIVE ANTIQUITY OF ANCIENT PERUVIAN BURIALS.

By AD. F. BANDELIER.

In his Pastoral letter of "*Exhortation and Instruction against indian Idolatry*" in the Archbishopric of Lima (then embracing, not merely the Peru of to-day but also Bolivia, Ecuador, and, according to the papal Bull dated January 31, 1545, also "Castilla del Oro in the province of Tierra firme, the city of León, in the province of Nicaragua and that of Popayan") Archbishop Don Pedro de Villagomez embodied an *Edict* dated November 25, 1647, commanding the "Visitors" of indian settlements to diligently investigate: "If they (the indians) have carried, or carry (transfer) the bodies of deceased christian indians to the burial places which they call Machais, where are their Malquis and (*whether for that purpose*) they have unearthed them from the church robbing (*stealing*) the said bodies of christian indians."<sup>1</sup>

The Synodal Constitutions of the Archbishopric of Lima from the Year 1636 declare: "Since we have understood that some Indians, chiefly Caciques and principals, from the Churches and parishes and from the Cemeteries where their fathers and relatives were buried disinter (in the absence of the Curates and sometimes at night—) the bodies, entombed in the said places according to the ceremonies of our Holy Mother the church and (*thus*) disinterred carry them to their ancient burial places in the mountains or to other remote sites;

<sup>1</sup> *Carta pastoral de Exortacion é instruccion contra las Idolatrias de los Indios del Arçobispado de Lima.* (Lima, 1640, folio 57.) "Si an lleuado, ó lleuan los cuerpos de los Indios difuntos christianos á las sepulturas, que llaman Machais, donde estan sus Malquis, y para ello los an desenterrado de la Iglesia hurtando los dichos cuerpos de los Indios christianos."—J. J. von Tschudi, *Die Kechua Sprache, Wörterbuch* (Vienna, 1853, page 366.) *Mallki* "mit diesem Namen werden gewisse menschliche Mumien, Skelette oder auch bloss Knochen bezeichnet, denen die alten Peruaner göttliche Verehrung zollten. In einigen Gegenden hiess überhaupt jeder Cadaver Mallki."—F: Diego de Torres Rubio, *Arte, y Vocabulario de la Lengua Quichua* (Lima edition of 1754, folio 75.) has: "cuerpo muerto.—Aya," and the term "Mallqui" is not in his vocabulary. But Machay (fol. 119.) is given as "cueva para dormir."—Tschudi, *Wörterbuch* (p. 366) has for "Machay" "das Grab."—The terms are explained in *Exortacion é instruccion* (fol. 39.): "Despues de estas Huacas de piedra, la mayor veneracion, y adoracion es la de sus Malquis, que en los llanos llaman Munaos, que son los huesos, ó cuerpos de sus progenitores gentiles, que ellos dicen, que son los hijos de las Hucaas. Los quales tienen en los campos en lugares muy apartados, en los Machais, que son sus sepulturas antiguas."—Both words are Quichua, although I could not, now, state to which one of the mountain dialects they may belong.

and since the aforesaid Vicars and Curates should take care that such abuses and offenses be not committed but punished, We Ordain that the said Vicars and Curates take particular pains in that the said excesses be remedied through preaching, and that they punish those who commit them.”<sup>1</sup>

The “*Exhortation and Instruction*” contains the further statement:

“But the chief abuse committed in this is that of disintering and taking away the dead from the church and carrying them to the Machais or burial places which they have in the fields of their ancestors, and (*which*) in some parts they call Zamay signifying sepulchre of rest, and (*the act of*) dying they call Zamárcan, (or) *Requievit*. And when asked why they do it they say, that it is Cuyaspa, for the love they have (*to them*) for they say, that the dead are with much pain in church, loaded with earth, while in the fields, being in the open air and not buried, they are more at rest.

“It should be noted (as important) that in no manner they be allowed to bury in vaults.”<sup>2</sup>

These decrees of the ecclesiastic authorities establish the fact that, as late as one-hundred and sixteen years after the first landing of Spaniards on the Peruvian coast and one-hundred and eleven years after the foundation of the city of Lima, not only did the indians still bury their dead according to primitive customs as often as possible, but took out those whom they had been obliged to inhumate after christian rites, to rebury them at such places and with such ceremonies as their *original* creed and beliefs taught them to perform.

<sup>1</sup> *Constituciones Synodales del Arzobispado de los Reyes en el Piru.* (Lima, 1722, the Concile was held under the auspices of Archbishop Fernando Arias de Vgarte. — Titulo de Sepulturis, Cap. IV, pag: 26.): “Para que los Curas, y Vicarios pongan mucho cuidado en que los Indios no desentierren de las Iglesias los cuerpos de sus difuntos, para llevarlos á sus Malquis, y sepulturas antiguas.”

<sup>2</sup> *Exortacion* (folio 47): “Pero el mayor abuso que en esto ay es el desenterrar, y sacar los muertos de las Iglesias, y lleuarlos á los Machais, que son las sepulturas que tienen en los campos de sus antepasados, y en algunas partes llaman Zamay, que quiere decir sepulcro del descanso, y al mismo morir llaman Zamárcan, requieuit. Y preguntados porque lo hacen? dicen, que es Cuyaspa, por el amor que les tienen, porque dicen, que los muertos estan en la Iglesia con mucha pena apretados cō tierra, y q̄ en el cāpo, como estan en el ayre, y no en terrados, estan cō mas descanso. A se de aduertir (como cosa que importa) que de ninguna manera se consienta que se entierren en bóvedas. The term “bóveda,” or vault, is to-day applied on the coast to subterraneous indian sepultures. But it must not be taken literally, for the underground chambers are not arched. They are merely cells, or rooms, below the surface in the sand, covered sometimes with reeds, supported by sticks or rough timber in general, and the sides protected against caving-in either by a lining of Adobe or a thin stone-wall. Zamani (also written Camani) means “rest.” Torres Rubio, *Arte y Vocabulario*, to die is: Huanuni (f. 134.)—The terms are not the same in every Quichua speaking community.



The second provincial council of Lima (March 2d to December 8th, 1567) had already issued strict orders against this custom,<sup>1</sup> and the first Archbishop of Lima, Don Fray Gerónimo de Loayza (1548 to 1575) instructed the Licentiate Pedro Mexia as follows: "Item:—You shall inform Yourself, of the Curates, whether they (*the indians*) have omitted to show the priests any corpse of their ancestors and (*whether they*) have some that were christians from the churches, and these bodies, and the bodies of the infidels that may come to light, you will cause to be buried on the sites destined (*reserved*) for infidels. And in case it were (*the body of*) a principal, You will take proper care that they may not take it up again, and You will also cause their sepulchres which You may find they worship from the time of their infidelity, to be sufficiently torn asunder, so that the memory (*of*) and respect for them be lost." <sup>2</sup>

In compliance with these ordinances (confirmed by the third Concile in 1583), a diligent search for primitive rites and customs had been instituted all over Peru. It revealed an astounding survival of ancient practices of all kinds, and led to the discovery of a large number of ceremonial objects. The Jesuits were chiefly entrusted with the task, and the names of Father Pablo Josef Arriaga,<sup>3</sup> Father Luis Terhuel, F: Pablo de Prado, and others remain forever identified with the "Extirpation of Idolatry in Peru."

In this crusade many objects of ancient worship were destroyed. But we must not forget that the original ceremonials of the indians entailed performances of the most reprehensible nature, including human sacrifice, and that the preservation of such remains for study was not, at that time,

<sup>1</sup> Cobo, *Historia de la Fundacion de Lima*, (1639, published at Lima in 1882, p: 201.)

<sup>2</sup> *Ynsiruccion de lo que a dehazer el Licenõ Pero Mexia clerigo Presbõ de la Compã de Jess en la visita general que el muy Exõ Señor Don francisco de Toledo visorrey destos reynos por orden de su Magd manda hazer.* (MSS. of the National Library of Lima. No date, but written between 1568 and 1575.) Paragraph 41.—"Yten os ynformareis en saber de los curas si an dexado de manifestar á los sacerdotes algun cuerpo de sus antepasados é an desenterrado algunos q heran Xpianos de las Yglesias y los cuerpos y los cuerpos de los ynfeiles que de nueuo se manifestaren los hareis enterrar en el lugar señalado para los ynfeiles y siendo persona principal terneis con el la cautela que combiene para q no la tornen á tomar y ansi mismo hareis desbaratar las sepulturas q halaredes tienen en reuerencia del Tpo de su Ynfidelidad en la parte dellas que baste para que se pierda la memoria y respeto en lo que las tienen."

<sup>3</sup> *Extirpacion de la Idolatria de los Indios del Peru.* (Lima, 1621.) I have not yet been able to consult this very rare book. Arriaga, among other things, claims to have taken away from the Indians 617 "Mallquis." Rivero and Tschudi, *Antigüedades peruanas* (Vienna, 1851, page 147. Note.)

thought of *anywhere*. Besides, as one of the foremost bibliographers and biographers of America, Don Joaquin Garcia Ycazbalceta of Mexico, justly observed: "Those who are simple enough to claim, like Clavigero, that such figures (*Fetiches or Idols*) might have been preserved in a Museum, do not understand the times. Neither do they wish to identify themselves with them for the sake of forming an opinion. What would the indians have thought, at seeing the missionaries preserve these idols with every care, placing them in halls and appointing persons for their attendance? Doubtless they would have interpreted such marks of attention as a kind of worship."<sup>1</sup> The "Extirpation of Idolatry in Perú" has brought about results compensating for this loss in material, and without which that material alone would only have been (as it largely is at present unless accompanied by laborious documentary investigations) an accumulation of subjects for ingenious conjecture. The Jesuits who persecuted Idolatry in Peru have left circumstantial descriptions of most of the objects destroyed, and, what is more important, of how they were used and for what purpose. To them we owe most of our knowledge about creed and worship of the Peruvian natives and a vast amount of information, which eyewitnesses of the conquest could not secure.<sup>2</sup>

Already in the middle of the sixteenth century the Augustin monks gathered valuable data in one or two districts of Peru. They preceded the Jesuits in the collecting and destroying of Idols and fetiches, and were careful to record traditions. Still, disinterment and reburial after ancient customs is not mentioned in the *Report on rites of the province of Huamachuco*.<sup>3</sup>

<sup>1</sup> *Don Fray Juan de Zumárraga primer Obispo y Arzobispo de Mexico.* (Mexico, 1881, page 347.) "Los que tienen la candidez de pretender como Clavigero, que tales figuras se hubieran conservado en un Museo, no comprenden la época, ni quieren trasladarse á ella para juzgarla? Que habrían pensado los indios, si vieran que los misioneros conservaban con todo cuidado aquellos ídolos, los colocaban en salas, y destinaban personas á su custodia? De seguro que habrían tomado por especie de culto esas muestras de estimacion."

<sup>2</sup> Several of the participants in the conquest have left valuable descriptions of customs of the indians at the time of their first contact with the Spaniards. But they had not leisure to penetrate deeply into matters that, to the indian, are most sacred, and which, therefore, he keeps most secret.

<sup>3</sup> *Relacion de la Religion y Ritos del Perú, hecha por los primeros Religiosos Agustinos que allí pasaron para la conversion de los Naturales.* (In *Documentos inéditos de Indias*, Volume III.) The date of this document is uncertain, but it cannot be posterior to 1561. It is translated into French and was published by Ternaux-Compans in his

Aside from the work of Arriaga and of what Father Terhuel recorded in his (as yet but imperfectly known) MSS., entitled *Contra Idolatriam*, the *Litteræ Annuæ* of the Jesuits convey important information. *The Annuæ Litteræ Anni 1613* describes a "Mission" among the indians of central Peru, in the course of which was discovered that "one of their principal Gods were the bodies of their deceased ancestors which they disinterred from the churches on All Souls' day and other days, in the absence of the Father their Curate, with great secrecy, and carried them to the clefts and heights where they placed them sitting and made great festivals for three days and nights without sleep (of which they were very particular) and among other ceremonies there were dances with much drunkenness, and finally they would depart, leaving them food and drink."<sup>1</sup>

The *Report on the Missions of the Huachos and Yauyos* from the same year is still more explicit. The eighth commandment which the medicine-men are said to have given the indians was:<sup>2</sup> "That they should bury their dead in the

*Recueil de documents et Mémoires originaux sur l'Histoire des possessions espagnoles dans l'Amérique.* (1840.) Work in Huamachuco began in 1555 about; *Relacion* (page 11.). The missionaries sent there and who secured most of the information conveyed by the document above, were Fray Juan de San Pedro and Fray Juan del Canto.

<sup>1</sup> *Annuæ Litteræ Anni 1613 Collegii Guamangani.* (MSS. from the National Library of Lima.) "pero vno de sus mas principales dioses eran los cuerpos muertos de sus antepasados los quales desenterraban de las Yglesias el dia de todos Stos y otros dias en ausencia del Pē cura con gran secreto y los llebaban á las quebradas y cerros donde los ponian sentados y alli hazian grandes fiestas por tres dias con sus noches, sin dormir (Pā lo qual hazian gran diligā) y entre otras fiestas auia bayles y danzas con muchas vorrcheras y al fin se despedian dellos dexándolos de comer y vever." — The Jesuit College of Guamanga was founded after 1586.

<sup>2</sup> *Misiones de las Prouincias de los Huachos y Yauyos* (MSS. of the Nat. Library of Lima, fol. 2.) "El 8º qē entierren á sus difuntos en los sepulchros de sus antepasados que era en los cerros principalmte los curis de Santiago y qē los Adoren y hagan los mesmos sacrificios qē a los huacos, ofreciendolos coca sauco quepo mulla y paria y qe cada año les muden las ropas qē era el dia de los finados y este dia les lleuen comida y de beber, y qē saquen y desentierren de las iglesias los cuerpos de los difuntos y qē sino pudieren en la yglesia les hagan las ceremonias posibles." It may not be devoid of interest to state, as far as possible, what the ceremonial objects above enumerated were. In this respect the *Exortacion* furnishes data, (folio 45.)

Coca: the leaves, in general use among mountain indians, especially for witchcraft. I do not translate the spanish text.

Sauco: Parpa or Saucu is a ball they make of cornmeal and keep it for sacrifices. Such balls of meal are used to-day among the Aymará. Coca leaves, in the shape of a trefoil, are put inside of the paste."

Quepo: A thistle. Torres Rubio. *Arte y Vocabulario* (fol. 108).

Mulla. — Should be Mullu (fol. 45). "Is a conch-shell of the sea, thick, and all have pieces of these shells; also they make beads out of this Mullu and put them on the Huacas, and of these beads they also use in their confessions." The Mullu is in general use to-day among the Aymará indians. Only, as they are far from the ocean, white stones replace the shells. Alabaster is the material mostly employed for the confection of the various images that serve for their innumerable sorceries.

Paria. — "Powder of a red color, like vermillion, which they bring from the mines of Guanacaelica, which is the metal from which they draw the quicksilver, although it rather resembles minium." Ground cinaber ore.

sepulchres of their ancestors which are in the hills (*mountains or cliffs*), especially the Curis of Santiago, and should worship them making the same sacrifices as to the huacas, offering them *Coca*, *Sauco*, *Quepo*, *Mulla*, and *Paria*, and that each year they should put new clothing on them, on All Souls' day, on which day they should fetch them food and drink. And that they should unbury and remove from the churches the bodies of their dead, and in case this were impracticable, perform in church the ceremonies to them that would be possible." The fact of idolatrous ceremonies being performed during mass is well established.<sup>1</sup>

Father Pablo del Prado and the lay-brother, Gonzalo Ruiz, then went "To search for and disinter the bodies of the dead that had been taken from the church to tall and abrupt heights and clefts which it was barely possible to reach by crawling on all fours, and we found an infinite number of them in some caves, all squatting and dressed and with much food, the walls and entrances sprinkled with the blood of animals. We took out all, selecting some thirty of those that had been governors, curacas, and prominent people. Of the others we made a great conflagration, burning them all. The 30, we had brought to the village, and in the center of the square, gathering all the people, we had them placed on striped sheep (Llamas) called moromoros, which is looked upon as the worst affront, and to the sound of trumpets and the voice of the public crier, who declared the reason why they were taken from the church and buried in the heights we had them burnt, and I preached to them afterwards against these evil rites and ceremonies. . . ."

"In this manner we discovered in the other villages many dead bodies and had them all burnt, as the greater part of them had, at the hour of death, asked to be removed from church. Others had asked to be carried to the place of burials, when they felt their end approach, in order to die there and gain indulgences and so, in various parts, we burnt more than four hundred bodies of these defunct people."<sup>2</sup>

<sup>1</sup> The documents above quoted relate several cases. At this day the indians of Bolivia still attempt to perform primitive rites in church.

<sup>2</sup> *Misiones de las Provincias de las Huachos y Yauos* (MSS: F. 3.): "Luego fuimos a buscar y desenterrar los cuerpos de los difuntos que auian sacado de la iglesia á vnos

To the testimony of ecclesiastic authorities and of the Jesuits, I add that of a well-known chronicler of the Augustines in Peru, Fray Antonio de la Calancha, born in Bolivia, 1584, and who lived in those countries to his death in 1654. He says:

"In the first years of their conversion they disinterred the deceased from the churches and cemeteries, to bury them in their Huacas, or on heights or levels, or in their own dwellings, and then drink, dance and sing, relatives and connections gathering, and they put, as before, gold and silver in their mouths, and new cloths under the shroud, that it might serve them in the other life. This superstition the Concile at Lima of the year 1567 ordered to eradicate in Chapter 103, and at this day there are still vestiges of the evil and they are caught in the (*act of*) body-snatching. . . ."<sup>1</sup>

"Even after they had been baptized they offered to their dead every year or every month jugs of chicha and eatables, singing dismal tunes, and this they are very particular to do on All Souls' day, the commemorative day of the Faithful dead."<sup>2</sup>

altos cerros empinados y vocas quebradas que apenas se podia ir á ellas arrastrando y gasteando y hallamos vna infinidad de ellos en vnas cuebas todos sentados en cucullas con sus vestidos y mucha comida rociadas las paredes y portadas de sangre de animales sacamos los todos escogiendo como 30 de los que auian sido gouernadores curacas y gente principal hicimos vna grande candelada de todos los demas y los quemamos alli mesmo. Los 30 hizimos lleuar al pueblo y en medio de la plaça auiendo conuocado toda la gente los hizimos poner encima de vnos carneros listados que llaman moromoros y son de maior afrenta y con trompeta y voz de pregonero que declaraua la causa porque se auian mandado sacar de la iglesia y enterrar en los cerros en medio de la plaça los hizimos quemar y uego luego les predique contra este mal rito y ceremonia con que quedaron todos muy auergonçados corridos y creo muy enmendados de hacer tal maldad. . . ."

— Moromoro is a name applied to Llamas of more than one color, spotted, striped, or speckled. Murumuru signifies: "many colored." Torres Rubio, *Arte etc.* (fol. 92.) Cobo, *Historia del Nuevo Mundo* (Vol. II, page 322). "Aunque pueden llevar una persona, nunca sirvieron de cavalleria á los indios. . . . Solo sirven hoy para este menester, quando los Corregidores y Justicias mandan azotar ó sacar á la verguenza algun indio, que para ellos es muy grande afrenta, y que la sienten más que los Azotes, el sacarlos caballeros en un Carnero destos . . . mas si es Moromoro, como ellos llaman, que es lo mismo que manchado de colores; . . ."

<sup>1</sup> *Coronica Moralizada del orden de San Agustin en el Perú.* (1638, Volume I, Lib: II, Cap: XII, page 376.) "En los primeros años de su conversiõ desenterravan los difuntos de las iglesias é cementerios, para enterrar los en sus quacas, ó cerros é llanadas ó en su mesma casa i entõces bevẽ, bayla i cãta iutãdose sus deudos i allegados, i les ponian como antes oro i plata en la boca, y ropa nueva tras la mortaja, para que les sirva en la otra vida. Esta supersticion mandó arrancar el Cõcilio segundo Limense del año de 1567 en el capitulo 103, i asta oy ay reliquias deste daño, i les cojen con el urto." — The statement that they put new cloth under the mortuary dress accounts for the presence, in most so-called "Mummy-bundles," of folded pieces of cloth that appear new, or at least unused. But the fact that they dressed the bodies anew is also established.

<sup>2</sup> (*Ibidem*, page 377.) "A sus difuntos, aun despues de bautizados les ofrecen ó cada año ó cada mes cantaros de chicha i comidas cãtando tonadas lametosas, i asi son tan puntuales en azer el todos Sãtos en el dĩa de la cõmemoracion de los fieles difuntos."

Reburial after primitive rites was, as already stated, accompanied by other rites of a primitive character. Pedro de Cieza states that on the Peruvian coast, "in times past they used to open the sepulchres and renew the cloth and food they had placed there."<sup>1</sup>

A writer from the seventeenth century, the Jesuit Cobo, asserts:

"They celebrated their anniversaries by going at certain times to the sepulchres, and, opening them, renewed the cloth and food they had placed in them and offered some sacrifices."<sup>2</sup>

"This custom has been continued to this day, and only a few years ago I saw a corpse which they had taken away from certain idolaters, so well prepared and arranged, that he seemed to be alive; for the face was so full and with such good color and skin that he did not seem to be dead, although he had died very many years previous."<sup>3</sup>

Not only was the ancient mode of burial extensively practiced until more than a hundred years after the first arrival of the Spaniards, but the cloth with which all the corpses (ancient and modern) were covered, was *periodically renewed, as late as the middle of the seventeenth century*. The fact, that food and drink also were replaced from time to time implies, that the vessels found along with the bodies *are no longer those originally buried with them*.

While the documentary evidence above presented covers, in fact, the whole of the former viceroyalty of Peru, it may not be superfluous to add some further testimony from what is now the Republic of Bolivia.

Calancha asserts, that while the Indians who inhabited the

<sup>1</sup> *Primera Parte de la Crónica del Peru* (In Volume I of the *Historiadores de Indias* by Enrique de Vedia, Cap: LXIII, page 416). "Y usaron en los tiempos pasados de abrir las sepulturas y renovar la ropa y comida que en ellas habian puesto."

<sup>2</sup> Father Bernabé Cobo, S. I. — terminated his *Historia del Nuevo Mundo* in 1653. He came to Lima from Spain in 1599, remaining in South America until 1630, when the order sent him to Mexico, whence he returned to Peru twenty years later. Enrique Torres Saldamando, *Los antiguos jesuitas del Peru*, (Lima 1885, pp. 99-100. I quote from the *Historia*, (Vol. IV, page 238): "Celebraban sus aniversarios acudiendo á ciertos tiempos á las sepulturas, y abriendolas, renovaban la ropa y comida que en ellas habian puesto, y ofrecian algunos sacrificios."

<sup>3</sup> Cobo, *Historia del Nuevo Mundo* (Vol. III, page 342). "Allegábase á esto, que tenían por opinion (y es la segunda razon porque los veneraban) que con estar conservados y respetados se multiplicaba la generacion; y así, se habia continuado esta costumbre hasta nuestro tiempo, y bien pocas años há que vi yo un cuerpo destos que

Island of Titicaca abandoned that island after the first appearance of the Spaniards, they still continued, during the sixteenth century and part of the seventeenth, to practice their ancient rites on it from time to time in secret.<sup>1</sup> Elsewhere I have called attention to this, stating that many of the burials there are not pre-conquistorial. This applies, naturally, not merely to corpses, but to all the objects in the graves. While investigating the ancient dwellings called Chullpas in northern central Bolivia, we were repeatedly informed of very recent burials in them, to which the Indians resorted in order to avoid exorbitant (and illegal) burial charges. Cave burials on the eastern slope of the Bolivian Cordillera, around Pelechuco and Charassani for instance, in fact, any burial in caves or cliffs in Peru, Bolivia, and Ecuador (also probably in Chile), appears chronologically doubtful in the face of the documentary evidence presented. It becomes difficult, hereafter, to distinguish pre-Columbian sepultures in those countries from post-Columbian. This does not affect the *manner* of burial, since it was always performed according to primitive custom, but its relative *Antiquity*. Art and industry of the Indians did not change at once upon contact with Europeans. Their textiles and, especially, the Pottery, was but slowly and gradually modified, and many specimens from graves (on the coast, for instance) may be, while after *primitive types*, still of comparatively *recent date*. It will demand careful scrutiny in many cases, assisted by documentary research, to ascertain if a burial is pre-Columbian or not. The deformation of skulls, common formerly in the Highlands of Peru and Bolivia, and (although different) also on the coast, is absolutely no criterion. The *Ordinances* of the Viceroy Don Francisco de Toledo,

quitaron á ciertos idólatras, tan bien curado y aderezado, que parecia estar vivo; porque tenia el rostro tan lleno, con tan buen color y tez, que nó parecia estar muerto, con haber muchísimos años que lo estaba." Even in the case of Mummies of undoubted pre-Columbian date, the cloth found on and along with them (especially the latter) is probably more recent than the original burial.

<sup>1</sup> *Coronica moralizada* (Vol. II, folio 31.) "En las Yslas ñ contiene su archipelago, i como mayor en la de Titicaca, ay gran cantidad de Yndios, ó fugitivos de la doctrina ó agraviados de los Corregidores, i Caciques, ó pescadores para grangerias, i no avrá pocos para asistir á la supersticion de sus idolatrias." (Fol. 78, Cap. XIV.) "A otros Religiosos cometieron el entrar á doctrinar en las Islas, de que tanto dejamos dicho, que estan en la gran laguna Titicaca, donde avia gran multitud de Indios; algunos con titulo de sus labranças, ó comercios, muchos por huir de la doctrina, i de el trabajo, otros por asistir en sus guacas, i adoratorios acõpañando á sus idolos, i todos, ó los mas, tenian de cristianos solamente ser bautizados."

framed between 1572 and 1575, embody a stringent prohibition of skull-flattening. Ordinance VIII, Tit. IX, Lib. II, directs:

"Item, I command, that no indian or indian woman squeeze the heads of newly born infants, as they are wont to do in order to make them longer, since from it there has resulted and results, great damage to them; and ecclesiastic Judges, Alcaldes and Caciques, shall take particular care that they do not do it any more."<sup>1</sup> This establishes that artificial deformation of skulls was extensively practiced as late as the close of the sixteenth century, and there is every likelihood that it was continued in the first half of the seventeenth; hence that many deformed skulls from so-called ancient graves date from years *after* the beginning of Spanish colonization, and are no evidence of pre-Columbian burial.

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<sup>1</sup> *Tomo primero de las Ordenanzas del Perú*. (1752, Lib. II, Tit. IX, folio 146.) "Iten, mando, que ningun Indio, ni India apriete las cabezas de las criaturas recién nacidas, como lo suelen hazer para hazerlas mas largas, porque de averlo hecho se les a recrecido, y recrece daño, y vienen á morir dellos; y desto tengan gran cuydado las Justicias Sacerdotes, y Alcaldes, y Caziques en que no le haga."



**Article XX.**—NEW BATS FROM TROPICAL AMERICA,  
WITH NOTE ON SPECIES OF OTOPTERUS.

By J. A. ALLEN.

During the last three or four years the Museum has received many bats from Central America, northern South America, and the West Indies, aggregating about 600 specimens, but pressure of other work has delayed until now any serious attempt at their identification. On working up this large amount of material it is not surprising to find that it contains a few hitherto undescribed forms.

In this connection I wish to express my great indebtedness to Mr. Gerrit S. Miller, Jr., Assistant Curator of the Division of Mammalogy, U. S. National Museum, whose great familiarity with the American Chiroptera is well known, for valued assistance in determining many of the forms, and for placing at my disposal the large collection under his charge.

About 200 specimens, representing most of our undetermined species, were taken recently to Washington for direct comparison with the identified material of the National Museum.

***Molossus coibensis*, sp. nov.**

Type, No. 18731, ♂ ad., Coiba Island, Republic of Panama, June 3, 1901; J. H. Batty.

Much smaller and much blacker than *M. obscurus* but with more massive skull and much heavier dentition.

Above deep blackish brown, a little lighter beneath; many shades darker throughout than any specimen of *M. obscurus* in a series of nearly a hundred specimens from Suapure and vicinity, Venezuela. Forearm 35 mm. (34.5–36 in three specimens), against 38 in *obscurus*; first metacarpal 37 (40 in *obscurus*); same proportional differences in other external measurements.

The skull, as compared with that of *M. obscurus*, is relatively broader and shorter, with broader and shorter braincase, broader and heavier rostrum, and heavier dentition, especially noticable in the upper incisors. The infraorbital foramen is lower and opens more anteriorly.

Based on four specimens from Coiba Island, Panama, formerly referred (*antea*, p. 78) to *M. obscurus*, but on re-examination they prove to be distinctly different.

The ventral surface of *M. coibensis* is as dark as the dorsal surface in the darkest specimens of *M. obscurus*, while the dorsal surface is nearly black. The difference in size, and the strongly marked cranial differences, readily distinguish it from *M. obscurus*, the only species with which it needs comparison.

***Molossus bondæ*, sp. nov.**

Type, No. 23661, ♀ ad., Bonda, Santa Marta, Colombia, Feb. 10, 1900; Herbert H. Smith.

Intermediate in size between *Molossus pretiosus* and *M. obscurus*, but nearer the latter. Above (type) reddish brown, clouded with darker; below paler, light reddish brown, slightly mottled with darker. Forearm and metacarpal III respectively 3 and 4 mm. (about one-twelfth) longer than in *M. obscurus*, and all the other external measurements proportionally greater. The skull is much larger, and relatively very much broader, with larger braincase, much wider palatal fossa, in correlation with the greater breadth of the skull. Compared with a large old skull of *obscurus*, the measurements are as follows: Total length, 18 mm. (in *obscurus* 16, in *pretiosus* 20.5); zygomatic breadth, 13 (in *obscurus* 11); width of braincase, 9.5 (in *obscurus* 9); width of palatal fossa, 3 (in *obscurus* 2.5). The dentition is correspondingly heavier, but the first premolar is conspicuously relatively much enlarged. The disparity in size is also especially striking in the lower jaw, which is one tenth longer in *bondæ*, with a corresponding increase in depth and in the size of the teeth. In respect to volume, the skull of *obscurus* is about one-half that of *bondæ*, and the skull of *bondæ* about one-half that of *pretiosus*.

Represented by the type (skin and skull) and three topotypes (in alcohol), collected by Mr. Francis C. Nicholas. The latter are dark brown, showing that the species is dichromatic, like *M. pretiosus*.

***Promops barbatus*, sp. nov.**

Type, No. 17570, ♂ ad., La Union, Venezuela, Sept. 27, 1901; S. M. Klages.

Near *Promops milleri* Allen, from Guayabamba, Peru, but smaller, with much narrower skull and lighter dentition.

Above brownish black, the basal portion of the fur paler; below dark brown, considerably lighter than the dorsal surface; a large pale axillary area. Ears and membranes blackish, the extreme tip of the wing lighter; posterior border of forearm and basal portion of metacarpals slightly furred; edge of upper lip strongly bearded. Ears medium, thick and heavy, the outer border slightly concave; antitragus with rounded border, higher posteriorly than anteriorly.

*Measurements.* — Forearm, 55 mm.; thumb, 5; third finger: metacarpal, 57, first phal. 25, second phal. 25, third phal. 75; tibia, 16; hind foot, 12; calcar, 17. *Skull*, total length 23; width of braincase, 10.2.

In comparison with *P. milleri* the skull is about one millimeter shorter, and the braincase one millimeter narrower; it is more constricted interorbitally, with the rostral portion relatively much broader as compared with the braincase; palatal region narrower, with the palatal fossa much narrower, in correlation with the greater interorbital constriction; teeth narrower, but the small premolar relatively larger than in allied forms; lower canines slightly separated. It is much smaller than *P. abrasus*, and differs from it in cranial characters in much the same way as it does from *P. milleri*. These three forms, however, are closely related.

### ***Dermonotus suapurensis*, sp. nov.**

Type, No. 17573, ♀ ad., Suapure, Venezuela, Oct. 26, 1901; S. M. Klages.

Similar in general features to *D. davyi* but very much larger. Forearm 51 mm., as against 45.5 in topotypes of *D. davyi*, and proportionate differences in other measurements, or about one tenth greater. *Skull*, total length, 17.2 (15 in *davyi*); zygomatic breadth, 10 (9 in *davyi*); width of braincase, 9 (8 in *davyi*); interorbital constriction, 4.5 (4 in *davyi*); height of braincase, 7.3 (6.5 in *davyi*); length of lower jaw, 8.2 (7 in *davyi*).

In bulk the skull is fully one third larger than in *davyi*, and nearly twice as great as in *D. davyi fulvus*. In the single known specimen the pelage is dark fulvous on the head, shoulders, and fore neck, much paler on the flanks and abdomen. Probably, however, it is dichromatic, like its allies of the Mormoopinae.

***Lonchophylla thomasi*, sp. nov.**

Type, No. 16120, ♂ ad., Ciudad Bolivar, Venezuela, Jan. 26, 1900; S. M. Klages.

Much smaller and much darker colored than *L. mordax* Thomas, from the coast near Bahia, Brazil; nose-leaf broader and shorter; skull smaller, rostral portion shorter, broader, and less tapering; brain-case more convex and higher.

Above dark russet brown, the basal two thirds of the fur pale buffy whitish; under parts similar, little if any lighter than the dorsal surface; ears and membranes blackish brown.

*Measurements*. — Forearm, 30 mm.; thumb, 7.5; third finger: metacarpal 32, first phal. 12, second phal. 15, third phal. 6; fifth finger: metacarpal 29, first phal. 8.5, second phal. 8; tibia, 12; hind foot, 9; calcar, 5; ear above crown (dry), 8. *Skull*, total length, 21; width of braincase, 8.

Through the kindness of Mr. Gerrit S. Miller, Jr., I have had the opportunity of comparing the present specimen with a topotype of *Lonchophylla mordax* Thomas in the collection of the U. S. National Museum, from which it differs strikingly in coloration, and also in respect to the size and general conformation of the skull, which is much smaller than that of *mordax*, and very different in proportions, but with which it agrees in details of dentition and the undeveloped condition of the zygoma. Unfortunately it is represented by only a single specimen.

Named for Mr. Oldfield Thomas, the distinguished mammalogist of the British Museum.

***Artibeus rusbyi*, sp. nov.**

Type, No.  $\frac{1255}{2377}$ , ♂ (?) ad., Yungas, Peru (alt. 6000 ft.), Sept., 1885;

Dr. H. H. Rusby. Named in honor of Dr. Rusby, the distinguished botanist, who collected the type.

Size large, one of the largest species of the genus; skull very elongate; prominent face-streaks.

Above dark seal brown from the shoulders posteriorly; head, neck, and shoulders much lighter; ventral surface nearly as dark as the back; fur basally lighter, dull grayish white, showing at the surface on shoulders and neck; face with four distinct, conspicuous white stripes — a pair from the posterior base of the nose-leaf to the upper anterior base of the ears, and one on each side from the angle of the mouth to the lower anterior base of the ears; ears and membranes dark brown,

the wings lighter apically, becoming yellowish white at the extreme tips. Wing membrane from the base of the toes. Proximal two thirds of fore arm above and upper surface of tibia heavily furred; interfemoral membrane wholly naked below, as are the wing membranes, except a narrow band of thin woolly fur along the proximal half of the forearm.

*Measurements* (from dry skin). — Forearm, 71 mm.; third finger: metacarpal 69, first phal. 24, second phal. 39, third phal. 24; tibia, 26; hind foot, 19; tragus, 4; nose leaf, 6 x 11. *Skull*: total length, 32; zygomatic breadth, 18.5; width of rostrum at canines, 9; width of braincase, 14; width at first molars, 14; postorbital constriction, 7. The braincase is gently convex, long, and low.

This species is nearly related to *A. palmarum* of Trinidad and adjoining parts of northeastern South America, but differs in the lower, less convex, and more spreading braincase, broader palate and heavier dentition, the upper tooththrow (canine and molar-premolar series) having a length of 11.5 mm. against 10.2 in *A. palmarum*; also in more prominent face stripes and darker general coloration.

It needs no comparison with any of the much smaller West Indian species, nor with *A. intermedius* of Costa Rica, characterized also by small size, but especially by a short, high-arched skull.

### ***Artibeus insularis*, sp. nov.**

*Type*, No. 19579, ♂ ad., Island of St. Kitts, W. I.

Size large; coloration pale, including membranes. Dorsal surface pale reddish brown, paler below; membranes pale brown; no head stripes. Nose-leaf large.

*Measurements* (alcoholic specimen). — Head and body, 82 mm.; nose-leaf, 13.5 x 8; width of interfemoral membrane, 13; ear from crown, 15; forearm, 61; thumb, 15; third metacarpal, 58; third finger, first phal. 18, second phal. 40, third phal. 20; tibia, 25.5; foot, 16.5. *Skull* (imperfect): Width across  $m^2$ , 13; width of rostrum at base of canines, 8.6; upper tooththrow ( $c-m^2$ ), 11; length of lower jaw, 19.6; height at coronoid, 8; tooththrow, 11.

Based on a single alcoholic specimen, a very old male, in excellent preservation, but with the skull badly broken. In external measurements it agrees very well with *A. jamaicensis*, in which the forearm ranges in five adults from 60–62

mm., averaging about 61. It is thus much larger than *A. parvipes* of Cuba, the forearm in which (in eight adults) ranges from 55–57 mm., averaging 5 mm. less than in *A. jamaicensis*. The skull, however, in *A. insularis* is much larger than in *A. jamaicensis*, the width across  $m^2$ – $m^2$  being 1 mm. (about one tenth) greater, and the rostrum at the base of the canines is also a millimeter wider, or about one eighth wider. This indicates a much larger and more massive skull than in *A. jamaicensis*, while the external measurements are about the same. The mandibular rami are straighter or less bowed and relatively slenderer. On the other hand, the skull is very much smaller than in *A. palmarum*, as are also the external measurements. It needs no comparison with *A. coryi*, which is a small species, about the size of *A. parvipes*.

***Artibeus yucatanicus*, sp. nov.**

Type,  $\frac{12038}{10469}$ , ♂ ad., Chichenitza, Yucatan, March 17, 1896; Frank M. Chapman.

Differs from *A. intermedius* from southern Mexico and Central America in smaller size and absence of head stripes, in both these respects resembling the West Indian forms of the genus, especially *A. parvipes* of Cuba, from which it is not readily distinguishable. Forearm, 55 mm.; third metacarpal, 57; tibia, 24; foot, 14. Three skulls average: Total length, 27 (type, 27.5); zygomatic breadth, 17 (type, 17.5); mastoid breadth, 14.4 (type, 15); interorbital constriction, 7.2 (type, 7). Four skulls of *A. parvipes* measure the same in total length, but a little less in zygomatic breadth.

As previously stated (this Bulletin, IX, 1897, p. 4), the Yucatan form closely resembles the Cuban form,—much more than it does specimens from southern Mexico (Isthmus of Tehuantepec and Jalisco), these latter being referable to *A. intermedius* of Costa Rica, though not typical.

Specimens from the lower Orinoco, Merida (Venezuela), and Santa Marta (Colombia) are not satisfactorily separable from *A. palmarum* of Trinidad, although Merida examples have a rather broader and more massive skull. Specimens from western Colombia are darker, but in size and cranial characters are not satisfactorily separable from *A. palmarum*. A rather different type, however, occurs at Yungas, Bolivia,

as noted above. Probably a large amount of material, from widely separated localities, would disclose a greater or less number of additional fairly recognizable forms.

In this connection it may be worth noting that in many skulls of *A. planirostris* examined, from various localities,  $m^3$  is found to be present on both sides in hardly more than fifty per cent. of the specimens; it is sometimes present on one side only, as has been noted by previous authors, being represented on the other side by the alveolus of the fallen tooth, while in fully one third of the skulls examined only the alveolus remains on either side. It may here be added that the specimen recorded above (*antea*, p. 79) from Boqueron, Chiriqui, as *A. intermedius* proves, on reëxamination, to be an example of *A. planirostris* with the third molar on each side absent.

***Phyllostomus hastatus panamensis*, subsp. nov.**

Type, No. 18705, ♀ ad., Boqueron, Chiriqui, Oct. 6, 1901; J. H. Batty.

Much larger than true *P. hastatus hastatus* from eastern South America.

Above dark seal brown, lighter and slightly varied with gray on shoulders, sides of neck, and front of head; below lighter brown, the extreme tips of the hairs grayish, giving a slight grayish wash; ears, nose-leaf, and membranes blackish brown. Five other specimens (topotypes) are similar, none showing any tendency to a reddish phase.

*Measurements* (type, from dry skin). — Forearm, 90 mm.; third finger: metacarpal, 83, first phal. 21, second phal. 42.5, third phal. 26; tibia, 34; foot, 24; calcaneum, 24. *Skull*, total length, 39; basal length, 30; zygomatic breadth, 21.2; mastoid breadth, 19; postorbital constriction, 7.5; width of rostrum at base of canines, 9.5; upper tooththrow ( $c-m^3$ ), 14.3.

In six specimens (2 males and 4 females), the forearm ranges from 86 to 90, averaging 88; third metacarpal, 80–83.5, averaging 82.5. Four skulls (2 males and 2 females, 2 others being too imperfect for measurement), total length, 37–39 (38.2); zygomatic breadth, 21–22.2 (21.5); mastoid breadth, 18.6–20 (19.3); width of rostrum (6 specimens), 9.2–10 (9.5).

Pallas's *Vespertilio hastatus* was based on Buffon's 'La Chouve-souris Fer-de-lance,' said to be "fort commune en Amerique," which may be construed as the eastern coast

of South America, probably 'Surinaam,' which may be considered as the type region of *P. hastatus* of modern authors. Assuming that specimens from the Island of Trinidad and eastern Venezuela (Cuidad Bolivar and Suapure) represent this form, *P. h. panamensis* is readily distinguishable by its much larger size. In six adult specimens—two from Trinidad and four from near Cuidad Bolivar—the skull ranges in total length from 35–37 (36); in zygomatic breadth, 19.5–20.3 (20); mastoid breadth, 18–19, and one old male 19.6 (18.5); width of rostrum, 8.2–9 (8.7). In nine specimens from the same localities the length of the forearm ranges from 80–82 (81); third metacarpal, 73–76 (74.6), as compared, respectively, with an average of 88 and 82.5 in *P. h. panamensis*.

The series of true *hastatus* includes both phases of coloration, the red and the dark; the dark specimens are similar in color to the *panamensis* series.

***Phyllostomus hastatus cauræ*, subsp. nov.**

Type, No. 14473, ♂ (?) ad., Cali, upper Cauca Valley, Colombia; J. H. Batty.

Larger than *Phyllostomus hastatus panamensis*, but apparently not otherwise different.

Type, deep rufous brown, lighter and more golden on shoulders, and sides of neck; ventral surface lighter than back. Of nine other specimens (topotypes) eight are in the red phase—several are like the type and others somewhat darker—and two in the dark phase, or very dark seal brown without rufous.

*Measurements* (type, from dry skin). — Forearm, 93 mm.; third finger: metacarpal 84, first phal. 20, second phal. 42, third phal. 23; tibia, 32; foot, 24; calcaneum, 21. Upper toothrow (c–m<sup>3</sup>), 14.6. In ten specimens the forearm measures 90–94 (92); third metacarpal, 82–86 (84.5), against 86–90 (88) and 80–83.5 (82.5), respectively, in *panamensis*.

The skulls are too imperfect to measure, all but one (a young adult) lacking the occipital portion. The dentition in both jaws is slightly heavier, and the rostrum is slightly broader than in *panamensis*, indicating a considerably larger skull.

Compared with true *hastatus*, the difference in size is strikingly marked, the forearm being fully one eighth longer,



with corresponding differences in other measurements. It differs much less from *panamensis*, but it apparently may well be recognized as a large Andean form of the *hastatus* group.

#### NOTE ON MEXICAN SPECIES OF OTOPTERUS.

In 1860 Saussure described a bat as *Macrotus mexicanus*, from an alcoholic specimen in poor condition collected at Yautepec, State of Morelos, Mexico. In 1890 Dr. Harrison Allen described *Macrotus bulleri* from slightly immature specimens taken at Bolaños, State of Jalisco, Mexico, and subsequently (*Bats of N. America*, 2d ed., 1894, pp. 41-43, gave a further account of it, based on additional material. These specimens I had previously referred provisionally (this Bulletin, II, 1889, p. 166) to *M. californicus*, and Dr. H. Allen made his comparisons with this species, making no reference to *M. mexicanus* Saussure.

In 1898 Dr. Merriam (*Proc. Biol. Soc. Washington*, XII, 1898, p. 18) compared topotypes of *M. mexicanus* with topotypes of *M. bulleri* and stated that he was "unable to find any characters on which the latter form can stand." I had previously recognized both *M. mexicanus* and *M. bulleri* as distinct species, and gave (this Bulletin, III, 1891, pp. 179-181) in considerable detail the differences that constitute them strongly marked forms; but I took for *M. mexicanus* a series of specimens from Tehuantepec City, State of Oaxaca, and compared them with series from Guadalajara and Bolaños, State of Jalisco. On recently going over the same material again, the two forms still seemed to me unquestionably specifically distinct. I thereupon asked Dr. Merriam to kindly loan me for examination topotypes of Saussure's *M. mexicanus*. These are now before me and confirm Dr. Merriam's statement that *M. bulleri* and *M. mexicanus* are identical, *M. bulleri* being a synonym of *M. mexicanus*. *Otopterus mexicanus* is therefore the small dark form, ranging from the State of Morelos westward to the Pacific coast and the Tres Marias Islands, so that a new name must be sought for the large light form occurring at Tehuantepec. This seems to be

furnished in the *M. bocourtianus* Dobson (1876), based on specimens from Vera Paz, Guatemala, which agree in size and other features with my Tehuantepec examples.

The measurements given by Saussure of his specimens are about all that his description furnishes in the way of diagnostic characters. These, in comparison with measurements of Tehuantepec specimens, of which I have a series of seven well-preserved alcoholic examples, indicate a much smaller animal, comparable with the so-called *bulleri*. Saussure's measurements here follow, with those of an average Tehuantepec specimen of *bocourtianus* in parentheses:

	mm.
Length of head and body.....	55 (61)
“ “ head.....	25 (27.5)
“ “ ears.....	21 (23)
“ “ tragus.....	10 (10)
“ “ nose-leaf, from base.....	7 (9)
“ “ forearm.....	51 (54)
“ “ tibia.....	23 (25)
“ “ calcar.....	10 (12)
“ “ tail.....	31 (35)

The synonymy of the two species will therefore stand as follows:

**Otopterus bocourtianus** (Dobson).

- Macrotus bocourtianus* DOBSON, Ann. and Mag. Nat. Hist., XVIII, 1876, 436; Cat. Chiroptera, 1878, 467. Vera Paz, Guatemala.  
*Macrotus mexicanus* J. A. ALLEN, Bull. Am. Mus. Nat. Hist., III, 1891, 179-181; *ibid.*, IX, 1897, 48. Tehuantepec City, Oaxaca, Mexico. Not of Saussure.

**Otopterus mexicanus** (Saussure).

- Macrotus mexicanus* SAUSSURE, Rev. et Mag. Zool., XII, 1860, 486. Yauatepec, State of Morelos, Mexico.  
*Macrotus californicus* J. A. ALLEN, Bull. Am. Mus. Nat. Hist., II, 1889, 166. Bolaños, Jalisco, Mexico. Not of Baird.  
*Macrotus bulleri* H. ALLEN, Proc. Am. Phil. Soc., XXVIII, 1890, 73; Mon. Bats. N. Amer., 2d ed., 1893 (1894), 41. Based on the Bolaños specimens, cited above.

*Macrotus bulleri* J. A. ALLEN, Bull. Am. Mus. Nat. Hist., III, 1890, 179; *ibid.*, IX, 1897, 48. The above-mentioned Bolaños specimens, and others from Guadalajara, Jalisco, Mexico.

*Otopterus mexicanus* MERRIAM, Proc. Biol. Soc. Washington, XII, 1898, 18. Tres Marias Islands, Bolaños, Jalisco, and the "State of Morelos," Mexico.

*O. bocourtiannus* differs from *O. mexicanus* in much paler coloration throughout, including the ears and membranes as well as the pelage, and in much larger size, the forearm being 3 mm., the third metacarpal 2 mm., the total length of the skull nearly 2.5 mm., and the zygomatic breadth over 1 mm. longer, respectively, than in *mexicanus*. In a considerable number of specimens of each examined, the range of individual variation leaves an unbridged gap between the two forms.



**Article XXI.**—*TELEORHINUS BROWNI*—A TELEOSAUR IN THE FORT BENTON.

By HENRY FAIRFIELD OSBORN.

The most important discovery of the Museum expedition of 1903 into the Cretaceous of Montana, under Mr. Barnum Brown, was the skull, the jaws, and a considerable part of the skeleton (No. 5851 Amer. Mus.) of a large teleosaurian crocodile, which establish for the first time the existence of this group in America. The animal is related to, but is generically distinct from, the European *Teleosaurus* and certain types referred to *Hyposaurus* in this country.<sup>1</sup>

I propose to refer this animal to a new genus and species, and take pleasure in naming the species after its discoverer, Mr. Brown, who has worked out the specimen with great care, and to whom I am indebted for several valuable observations.

**Teleorhinus, gen. nov.**

Cranium teleosauroid. Nasals continued forward to form roof border of anterior nares. Splenials prolonged into symphysis. Teeth compressed anteroposteriorly, uniformly grooved in front and behind.

**Teleorhinus browni, sp. nov.**

Forty maxillary and premaxillary teeth. Premaxillary teeth straight, maxillary teeth recurved.

The skull (1000 mm.) and jaws (996 mm.) are preserved entire, with a large number of the upper teeth. The skull in the upper view exhibits great breadth between the orbits, which are placed laterally. Large supratemporal fenestræ. Few sutures can be made out. The fronto-prefrontal elements connect anteriorly with the greatly elongated nasals which border the roof of the anterior nares.

The vertebræ are amphicœlous or amphiplatyan.

Nine *cervicals* are preserved. Atlas with hypocentrum,

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<sup>1</sup> Compare O. P. Hay, Bibliography and Catalogue of the Fossil Vertebrata of North America, p. 516.

neurocentra (neural arches), and a single transversely extended proatlas with median spine. Axis with firmly united odontoid (pleurocentrum of atlas), with paired hypocentra indicated, but not osseous or preserved; with prominent and elongate spine. Remaining cervicals with very broad ribs, articulating with depressed dia- and parapophyses. At least twelve dorsal centra are preserved, without upper portion or neural spines. The single sacral preserved has a broad sacral rib attachment directly opposite the centrum; the centrum is amphiplatyan and front and back surfaces are of equal size. The mid-caudal centra are laterally compressed, with chevron facets.

Of the limb bones the femur and humerus are preserved complete. Both are much straighter than in *Hyposaurus* and greatly reduced in length. The dermal scutes are elongated and shallow-pitted.

In case the name *Teleorhinus* has already been used, the name *Terminonaris* may be applied to this genus, and thus anticipate those who "reap without having sown."

Article XXII.—NEW OR LITTLE KNOWN MAMMALS  
FROM THE MIOCENE OF SOUTH DAKOTA.  
AMERICAN MUSEUM EXPEDITION OF 1903.

By W. D. MATTHEW and J. W. GIDLEY.

Part I.—Geological Notes, J. W. G.

“ II.—Carnivora and Rodentia, W. D. M.

“ III.—Dicotylidæ, J. W. G.<sup>1</sup>

I. GEOLOGICAL NOTES.

The work of the American Museum Expeditions of 1902 and 1903 under the William C. Whitney fund was confined chiefly to the Miocene exposures along the Little White River, South Dakota, and the Niobrara River in the vicinity of Fort Niobrara, Nebraska. This region is of special interest and importance, as it was visited in early days by parties of the U. S. Geological Survey, and it was at these localities that the government parties under F. V. Hayden, in 1857, obtained most of the typical Loup Fork<sup>2</sup> material afterward described by Leidy.

All the localities visited by the American Museum parties present two distinct terranes of the Miocene series. The lower beds represent probably the lowest stage of the Lower Miocene, while the upper beds, which are true Loup Fork, belong to the uppermost Miocene. There are no traces of the Middle Miocene in this region.

UPPER MIOCENE.

*Loup Fork Beds.*

Although the typical Loup Fork locality is on the Loup Fork River, thirty or forty miles south of Fort Niobrara, Nebraska, there seems no doubt that the terrane at that

<sup>1</sup> Parts IV and V, Equidæ, J. W. G., and Camelidæ, W. D. M., will be published when the preliminary studies of these groups are completed. The new Rhinoceroses in the collection will be described by Prof. H. F. Osborn, along with other new Miocene Rhinoceroses, in a paper shortly to appear.

<sup>2</sup> Loup Fork is used in the present paper in its limited sense as a terrane and not as a time division.

place is continuous with the beds in the vicinity of Fort Niobrara and the Little White River.

The Loup Fork beds, in the region examined by the American Museum parties, lie unconformably on the much eroded surface of the Lower Miocene. Large areas of the beds are covered by recent formations of sand and prairie loess known as sand hills, with occasional small areas of Pleistocene deposits. These 'sand hills,' although made up mostly of a coarser and purer variety of sands than the underlying formations, have evidently been derived from the broken down and rearranged deposits of the Loup Fork and Pleistocene beds; the Pleistocene, in its turn, being chiefly made up of rearranged Loup Fork deposits.

The evidence for such an explanation of the origin of these vast sand deposits is found in a study of present conditions in the localities where they now occur. Wide expanses of country are entirely bare or only sparsely covered with vegetation, thus there is practically no protection from the action of strong winds which for the greater part of the year are of almost daily occurrence. Under the wind action the loose materials of which these beds are composed, constantly shifting about, are scooped out into deep pits or hollows and piled into great mounds many feet in height, each change in the direction of the wind causing a rearrangement of the materials. It is obvious that in this constant shifting of materials the wind acts as a great separator, the heavier, coarser sands, moving but a short distance, remain in the vicinity, while the finer, lighter materials, especially the finely divided clays, are finally carried entirely away to be deposited elsewhere as prairie loess.

The Loup Fork beds are composed principally of sands more or less intermixed with clay, and in places highly impregnated with lime and interwoven with characteristic root-like concretions. In the opinion of the writers, the character of the formation of the Loup Fork beds shows that they are not of lake origin, as has been generally supposed, but were deposited by the action of rivers or streams with extensive flood plains and frequently shifting channels, augmented



doubtless by large quantities of material carried by the winds from the surrounding plains. The conditions under which these deposits were laid down were very probably similar to those existing to-day in some sections of the Great Plains, especially portions of the Platte River Valley.

The Loup Fork beds extend over a wide area of country, roughly about one hundred and fifty miles long by fifty miles wide. They have a comparatively even thickness of about 100 feet. There is a total lack of uniformity in sedimentation and much variation in thickness of the principal strata composing the beds. There are numerous ancient stream channels, usually containing interstratified and cross-bedded materials of a coarser nature than the surrounding beds, quite often being intermixed with coarse gravel and large lumps of water-rolled clay. These channel formations occur at any level and are widely distributed over the beds. We found indications of them near the head of the Little White River, at Big Spring Cañon, sixty miles west of the Rosebud Indian Agency, at various places along the Little White River, and in the vicinity of Rosebud Agency, at the head of Oak Creek, thirty miles east of Rosebud, and in the vicinity of Fort Niobrara, Nebraska. At Big Spring Cañon we found indications of four successive stream channels, each cutting through the filling of its predecessor. These were: (1) A Miocene channel in the bottom of which we found an articulated skeleton of *Procamelus* surrounded by numerous separate bones of camels, horses, etc. (2) A second Miocene channel cutting off one end of the bone layers in the bottom of the preceding channel and filled with similar but somewhat softer and finer sand partly consolidated. (3) A later channel, probably Pleistocene, filled with loose sand. (4) The modern gully.

The condition, preservation, and distribution of the fossil remains, as well as the predominance of land animals, found in these beds also argue strongly against lake conditions during their deposition. The following observed facts seem to point to stream and plains conditions. The fossils occur most frequently in the channel formations. There are numerous scattered and fragmentary bones in

every locality where the Loup Fork beds are exposed, yet but few of the fragments show water-worn edges; most of the bones show unmistakable signs of weather checking, even in articulated skeletons. There are occasional deposits, of small area, in which are thickly imbedded the bones of Proboscidi-ans, Rhinoceroses, Horses, Camels, Carnivores, Rodents, etc., indiscriminately mixed. The bones are for the most part disarticulated and disassociated, many of them being broken and the pieces separated. The conditions for such a deposit of bones are furnished by the numerous temporary springs and ponds found to-day in the Western Plains country. Many animals seeking water become mired in these places during certain seasons and their bones are gradually buried. As these miry places gradually dry up animals can wade further and further toward the center until finally they can walk with safety over places which a few weeks before had been veritable mire holes. Under these conditions carcasses of animals which had been mired earlier, being only partially covered, are pulled apart by carnivorous animals and the bones more or less scattered, many of them being broken by heavy animals stepping on them in wading through the partially stiffened mud as the miry places are gradually dried up. Another season of rainy weather comes, the place again becomes miry, the bones already accumulated sink deeper, other animals are mired and their bones are added to the deposit. This alternation from wet to dry or nearly dry conditions is sometimes carried on for many years until many bones of numerous varieties of animals are accumulated.

Davis, Johnson, Hatcher, Matthew, and others have given extended discussions of the highly interesting subject of the origin of Tertiary deposits of the Western Plains and Rocky Mountain regions, in which they seem to agree that, except for such formations as the Green River shales of the Eocene in Wyoming, these vast deposits were not laid down in extensive lakes, as has been generally believed and taught by leading geologists, but that their origin is much more satisfactorily explained by alluvial fans, river and flood plains, and subaërial conditions.

We are in entire accord with these more modern views. Without at present going into a further discussion of the subject we wish simply to present here the foregoing observations which seemingly suggest a somewhat different phase of continental deposition from those presented by the above mentioned authors.

### *Faunal List.*

Camels and Three-toed Horses are the most abundant fossil mammals in this formation at all the localities visited. Other mammals, though much less common, present considerable variety. Remains of land-tortoises are more frequently seen than any of the mammals, and silicified wood (rolled logs as far as our observations go) is found in large quantity in some places.

Following is a list of the mammals found in the Loup Fork sands by our party:

<i>Ischyrocyon hyænodus.</i>	<i>Merychippus</i> sp.
<i>Ælurodon sævus.</i>	<i>Hypohippus</i> sp.
“ <i>haydeni.</i>	“ sp.
“ <i>? wheelerianus.</i>	<i>Peraceras ? malacorhinus</i>
<i>? Amphicyon</i> indet.	<i>? Diceratherium</i> sp.
Canid, gen. indet.	<i>Teleoceras</i> sp.
“ “ “	<i>? Trilophodon</i> sp.
<i>Potamotherium lacota.</i>	<i>Prosthennops crassigenis.</i>
<i>Lutra pristina.</i>	<i>Procamelus robustus.</i>
Insectivore, gen. indet.	“ <i>occidentalis.</i>
<i>Mylagaulus monodon.</i>	<i>Pliauchenia</i> sp.
<i>Dipoides tortus.</i>	<i>Ticholeptus</i> sp.
<i>Neohipparion occidentale.</i>	<i>? Merycochærus</i> sp.
“ <i>whitneyi.</i>	<i>Palæomeryx</i> sp.
“ sp.	“ sp.
“ sp.	<i>Blastomeryx wellsii.</i>
<i>Protohippus ? perditus.</i>	<i>Merycodus necatus.</i>
“ sp.	“ sp.
“ sp.	

### LOWER MIOCENE.

#### *Rosebud Beds.*

The lower formation above mentioned, for which we propose the local term *Rosebud Beds*, is best exposed along the

Little White River and in the vicinity of the Rosebud Agency. These beds closely resemble portions of the upper Oligocene beds, both in character and general appearance, except that they contain a little more sand. In certain exposures an examination of the fossils contained in the beds is necessary to determine their horizon. The Rosebud Beds are possibly equivalent to the formation of similar appearance (*Gering Beds*, of Darton) so abundantly exposed in the northwest corner of Nebraska. Lithological determinations in these river and plains deposits are, however, so unreliable that palæontological evidence, which at present is not at hand, is absolutely necessary to settle this point.

Fossil remains are very rare in the Rosebud Beds, yet enough characteristic specimens were found by the American Museum parties to show that they are true Miocene but belong near the bottom of the series.

#### *Faunal List.*

Canid indet., cf. *Cynodesmus*.

*Steneofiber pansus*.

*Meniscomys* sp.

? *Eporeodon*.

*Merycochærus* vel *Promerycocharus*.

*Merychyus*, cf. *elegans*.

## II. CARNIVORA AND RODENTIA.

### CANIDÆ.

#### **Ischyrocyon**, gen. nov.

*Char. gen.* — Dentition  $\overline{3.1.4.3}$ . Molars without metaconid or entoconid. Premolars reduced, massive, crowded, without heel-cusps except on  $p_4$ , and with no accessory posterior cusps. The dental formula and relative sizes of premolars and molars are as in *Amphicyon*, but the cusp composition of the molars is that of *Cyon*. All the teeth are very massive. The lateral incisor is exceptionally large. First premolar two-rooted.

#### **Ischyrocyon hyænodus**, sp. nov.

*Char. spec.* — The type, No. 10802, is the complete right ramus of the lower jaw of a young individual, with the permanent teeth pre-

formed in the jaw but not yet erupted, and of the milk dentition the third premolar only remaining in its alveolus. The lateral incisor, first premolar, and first molar of the permanent dentition are partly erupted; the third permanent molar is not calcified, although the cavity for its reception is completed.

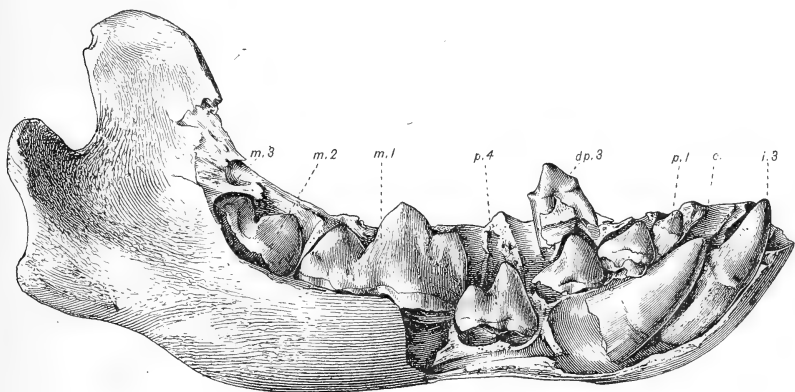


Fig. 1. *Ischyrocyon hyænodus*. Type, No. 10802. External view of immature jaw, with the outer wall removed to show permanent dentition within the jaw. One half natural size.

The size of the species equalled that of the largest *Amphicyon*s, judging from the size of the teeth. The jaw has by no means reached its full size, and is about as large as that of a small grizzly bear.

The alveolus of  $i_1$  is 6 mm. in diameter and close to the anterior border of the symphysis. The second alveolus is 10 mm. in diameter, and is almost directly behind the first. The third incisive alveolus lies external to the second and contains the incisor partly erupted. This tooth is large in proportion to the jaw, high and pointed, with compressed root, strong internal and external ridges, and an obsolete posterior basal cingulum, but no accessory external cusp. It is more like the corresponding tooth in the *Machærodont*s than in any *Canid* with which we are acquainted. It suggests a milk canine rather than an incisor, but its position in the jaw precludes that explanation, and the alveolus of the milk canine, a considerably smaller tooth, is perfectly preserved just external to the permanent canine.

The permanent canine is a large, very massive cone, of round-oval section, with comparatively little curve, and with well-defined posterior and internal ridges.

The temporary premolars are lost except  $dp_3$ . Their alveoli show that  $dp_1$  was quite small, apparently one-rooted, the others larger, two-rooted.  $Dp_3$  is wider posteriorly than the corresponding tooth in *Canis*, has a small heel-cusp, but no accessory cusp. The milk

carnassial ( $dp_4$ ) appears to have been a rather stout tooth of about 21 mm. length, the posterior root a little larger than the anterior.

The permanent premolars are proportionately small, but remarkably stout and massive, two-rooted,  $p_4$  with well-developed heel-cusp, but no accessory posterior cusp. The others have no heel-cusp, the heel being merely broadened out and a little flattened. The two roots of  $p_1$  are close together, and united towards the crown, so that the tooth has the general form of a one-rooted tooth.  $P_4$  is 24 mm. long and 14 mm. wide.

The permanent carnassial is a very large tooth, 45 mm. long and 21 wide. The heel is as large as in *Amphicyon*, but the entoconid ridge is

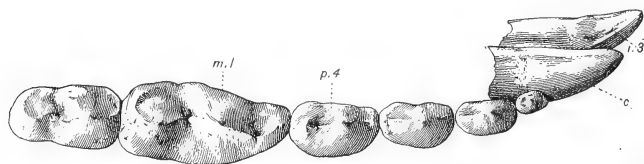


Fig. 2. *Ischyrocyon hyanodus*. Type. Crown view of teeth, one half natural size.

very slight. The protoconid and paraconid are much higher than in *Amphicyon*, considerably higher than in *Canis occidentalis*, and there is no trace of the metaconid. The heel-cusp is much higher than in *Amphicyon*, and more central in position, but its form is otherwise the same.

The second molar is very large, 28 mm. long and 17 wide. The trigonid consists of a single massive cusp, with anterior, posterior, and postero-internal ridges, and the heel is of the same form, but lower and a little smaller.

The third molar is not calcified and was a small tooth, judging by the size of the cavity for its reception.

The form of the jaw is much as in *Amphicyon*, with short, wide coronoid process, little development of the angular process, and the excavation beneath the coronoid for attachment of the masseter, very shallow and ill defined. The inferior outline is less curved than in *Ælurodon*, *Canis*, or *Simocyon*, more as in *Amphicyon*, *Ursus*, or *Hyæna*. The anterior portion of the jaw is very deep and massive, also as in the three last-mentioned genera.

Found by W. D. Matthew in the Upper Miocene, Loup Fork formation, near Rosebud Agency, S. D.

It is difficult to say where this genus should be placed among the Canidæ. The general proportions suggest *Amphicyon* and *Dinocyon*, but the high carnassial and absence of metaconids on both molars forbid any near relationship.

In all other Canidæ the post-carnassial teeth are relatively small. In *Ælurodon* the metaconid is always small on  $m_1$ , and sometimes on  $m_2$ , but the heels of these teeth have always a strong internal cusp or ridge, and  $m_2$  and the heel of  $m_1$  are as small as among the typical Canidæ. *Cyon* and *Temnocyon* differ in the large trenchant premolars with well developed accessory cusps and the small size of  $m_2$  and of the heel of  $m_1$ . *Enhydrocyon* and *Hyænocyon* have likewise the normal small  $m_2$  and small heel to  $m_1$ , if one may judge from the cotype specimens. Their premolars, although suggesting those of *Ischyrocyon* in form, have accessory cusps above the heel-cusp. The recently described *Hyænognathus* Merriam has a differently shaped  $p_4$ , anterior premolars more reduced, and post-carnassial dentition of the normal small size. For the large and peculiarly shaped lateral incisor of *Ischyrocyon* we can find no parallel among the Canidæ or related families; but it appears in the Machærodonts.

*Measurements of Type, No. 10802.*

Total length of immature jaw, 212.

Depth of jaw under  $dp_3$ , 49; at  $m_2$ , 53; at coronoid process, 84.

*Temporary Dentition.*

Alveolus of canine, antero-posterior, 15; transverse, 8.

Third molar ( $dp_3$ ) " 14; " 7.

Alveolus of carnassial ( $dp_4$ ) " 22; " 9.

*Permanent Dentition.*

Alveolus of  $I_1$ , antero-posterior, 5; transverse, 4.

"  $I_2$ , " 10; " 5.

$I_3$ , antero-posterior, 15; transverse, 11; height of crown, 24.

$C$ , " 20.5; " 16; " " " ?

$P_1$ , " 8; " 6; " " " 7.

$P_2$ , " 16; " 10; " " " 11.

$P_3$ , " 10; " 12; " " " 13.

$P_4$ , " 24; " 14; " " " 17.

$M_1$ , " 45; " 21; " " " 29.

$M_2$ , " 28; " 17; " " " 17.

Chamber for  $m_3$ , antero-posterior diameter, 7.

***Ælurodon* Leidy.**

An upper jaw, two lower jaws, and other more fragmentary specimens were found by our party. They are referred to two species, *Æ. sævus* Leidy and *Æ. haydeni* Leidy.

The species of this genus were clearly differentiated by Professor Scott in 1890. We are now able to add to his characterizations of the species, as follows:

*Ælurodon sævus* Leidy. Upper and lower premolars (except  $p_4$ ) reduced, not crowded, without anterior basal cusps. Lateral upper incisor moderately large. Second molar of moderate size.

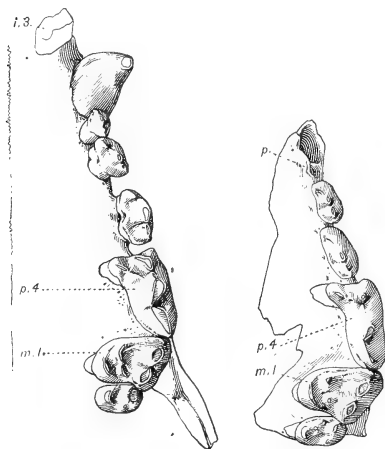


Fig. 3. *Ælurodon wheelerianus* Cope and *Æ. sævus* Leidy. Upper teeth of the right side, crown view, one half natural size. Nos. 8307 (Cope Coll.) and 10804 (Exped. 1903).

*Ælurodon haydeni* Leidy. Upper jaw unknown. Lower premolars reduced, crowded,  $p_2$  set transversely in the jaw, all without anterior basal cusps.  $M_2$  elongate, larger than in *Æ. sævus*. Alveolus of  $m_3$  set in ascending ramus of jaw, varying considerably in the known specimens. In Leidy's type it is two-rooted; in the Harvard specimen described by Professor Scott and in one of ours (No. 10805, Upper Miocene, S. Dakota) it is one-rooted; in another specimen in our collection (No. 9744, Upper Miocene, Montana) it is absent, the alveolus closed.

*Ælurodon wheelerianus* Cope Upper and lower premolars larger, not crowded, all with anterior basal cusps. Tubercular teeth reduced in size.  $I^3$  very large.

*Ælurodon taxoides* Hatcher is hardly distinguishable from *Æ. wheelerianus*, except by the absence, according to the published figures, of the anterior basal cusp on  $p_2$  and  $p_3$ . Mr. Hatcher does not compare his species with *Æ. wheelerianus*, Cope's figure of which, in *Tertiary Vertebrata*, p. 945, is very misleading.

The characters of *Æ. sævus* are derived primarily from the fine skeleton in the Cope Collection, Amer. Mus. No. 8305, which agrees very well with Leidy's type. The teeth are con-



siderably worn. An upper and a lower jaw, Nos. 10804, 10806, from S. Dakota, show the characters of the unworn teeth, and a number of other specimens are referred to this species. The type of *Æ. wheelerianus* is a lower jaw from New Mexico (Nat. Mus. Coll.) with the teeth mostly broken off; a fine palate and jaws in the Cope Collection (No. 8307,

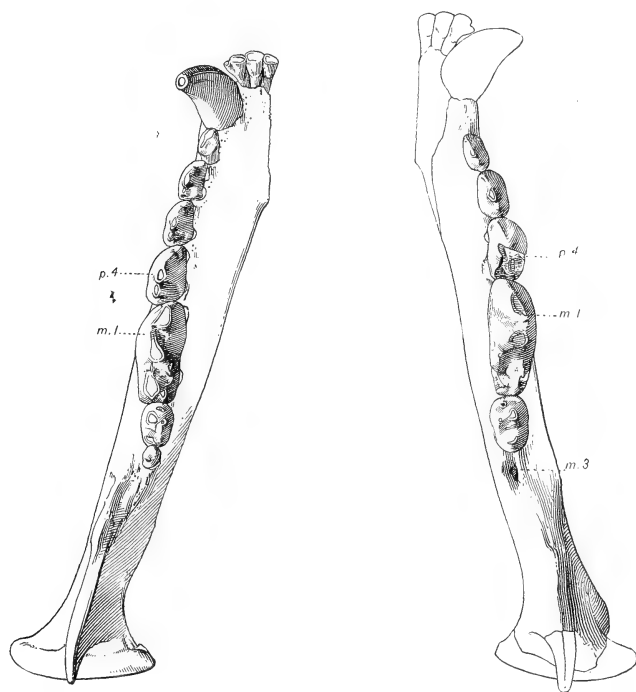


Fig. 4. *Elurodon wheelerianus* Cope and *Æ. savus* Leidy. Lower jaws, from above one half natural size. Nos. 8307 (Cope Coll.) and 10806 (Exped. 1903).

Nebraska), and a single lower jaw from the same locality (No. 8308) show the tooth-characters of the species. Of *Æ. haydeni* we have but two specimens, both lower jaws (No. 9744, Montana; No. 10805, S. Dakota), agreeing fairly well with Leidy's type. We have seen no additional specimens of *Æ. taxoides*.

Five other species have been referred to this genus.

*Æ. compressus* Cope is much smaller than any of those

hitherto mentioned, the teeth are much more compressed, the jaw not so deep nor thick, nor is the symphysis so heavy. It is probably not *Ælurodon*, but one of the more typical Canidæ.

*Æ. hyænoides* Cope is doubtfully a Canid and certainly not *Ælurodon*. The heavy antero-internal cusp of  $p^4$ , widening of inner part of  $m^1$ , and stout rounded anterior premolars are unlike any Canidæ in which these parts are known. It seems

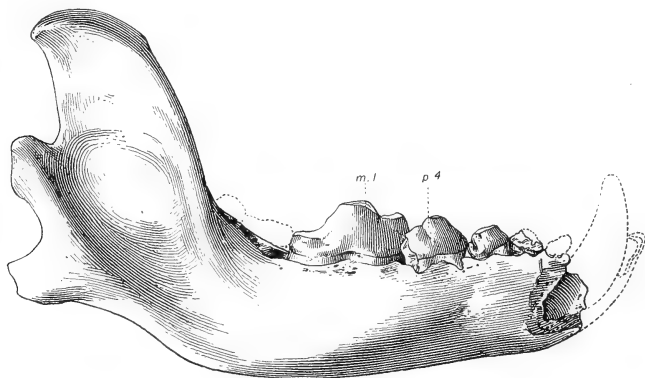


Fig. 5. *Ælurodon haydeni* Leidy. Lower jaw, No. 10835, Loup Fork beds, South Dakota. One half natural size.

equally difficult to refer it to any other Carnivore family with our present inadequate knowledge of the species.

*Æ. ursinus* Cope and *Æ. mæandrinus* Hatcher are probably not *Ælurodon*s, and have been provisionally referred by Matthew to the Amphicyonines.

*Æ. ? brachygnathus* Douglass is defined by its author on characters common to the genus. The type is a jaw with all the teeth broken off, and we are unable to discover any distinguishing characters in Mr. Douglass's figure.

#### Canid, sp. indesc.

A lower jaw with teeth broken off represents a species of dog apparently undescribed. The carnassial was a little larger than in the cotype of *C. temerarius*, the jaw about one half deeper. The teeth are compressed as in the coyote, but the jaw is short and stout, and very deep beneath the molars.

*Dimensions.*

P <sub>3</sub> , alveolus, antero-posterior,	8.
P <sub>4</sub> , roots,	" 10.
M <sub>1</sub> , broken,	" 22, transverse 7.
M <sub>2</sub> , roots,	" 10.
M <sub>3</sub> , alveolus,	" 8.
Depth of jaw beneath p <sub>3</sub> 17, beneath m <sub>1</sub> 25.	

**Canid**, sp. indesc.

Another jaw with broken-off teeth represents a somewhat larger species, also apparently undescribed. The molars are a little larger than those of "*Ælurodon*" *compressus*, but the premolars are larger in proportion and the jaw much deeper and heavier. It may be a small *Ælurodon*.

*Dimensions.*

P <sub>4</sub> , root, antero-posterior,	11.
M <sub>1</sub> , broken,	" 22, transverse, 9.
M <sub>2</sub> , broken off,	" 10.
M <sub>3</sub> , alveolus,	" 6.
Depth of jaw beneath p <sub>3</sub> , 23, beneath m <sub>2</sub> , 28.	

The above species, with *Ælurodon compressus* and probably other described forms, are distinguished from *Canis* by their short jaw and small close-set premolars. *Canis brachypus* Cope has the slender jaw of the wolves and is a larger species. *C. vafer* is much smaller. *Cynodesmus thooides* Scott is smaller and comes from a lower horizon. We prefer not to propose new specific names on such imperfect specimens, and describe these merely to indicate the variety of cynoid forms that has been found in the Miocene of this country, few or none of them properly referable to the genus *Canis*.

## MUSTELIDÆ.

**Potamotherium** *E. Geoffroy*.

Distinguished from *Lutra* in the lower jaw by having four premolars, a much narrower carnassial with the protocoenidparaconid blade much higher, and the heel small and

compressed. The type is *P. valetoni* of the European Oligocene (St. Gerand-le-Puy). In the North American Miocene there are several little known species which have been or may be referred here.

*P.* ("Lutricitis") *lycopotamicum* Cope from the Mascall formation of Oregon was based on a jaw broken just behind the carnassial, so that the character of the following molar or molars is unknown. The type was not figured, and has been lost, and no other specimens referable to the species have been discovered, so that we cannot verify the correctness of the reference. It was a small species, about the size of a mink.

"*Stenogale*" *robusta* Cope probably belongs here rather than with *Stenogale*, in which genus the jaw and teeth are very much compressed, the heel of the carnassial much smaller and narrower, and  $m_2$  much more reduced. It agrees fairly well with *P. valetoni*; the anterior part of the jaw is not so heavy, the premolars are not so wide, and the shear-cusps of the carnassial lower.

*Brachypsalis pachycephalus* Cope, which has been referred to *Potamotherium*, appears to be a quite different animal; the jaw is extremely short and massive and the masseteric fossa of peculiar form. The teeth are broken off in the type, and no other specimens are known, so that we are unable to state its relationship; but it appears to be a valid genus.

### ***Potamotherium lacota*, sp. nov.**

A lower jaw (No. 10810) of a much larger species than *P. valetoni* is referred provisionally to this genus. The front of the jaw is considerably more elongate than in the type species, the premolars larger, higher, and more compressed. It resembles *P. robustum* Cope, but is more slender and very much larger; the heels of the premolars, especially  $p_4$ , are considerably more broadened out than in either *P. robustum* or *P. valetoni*. The crowns of the fourth premolar and carnassial are broken off, but the carnassial appears to have had the same proportions as in the smaller species. The alveolus of

$m_2$  is rather larger than in these species, and nearly round, flaring towards its borders and with somewhat raised edges, indicating probably that the tooth had a flattened crushing surface like that of *Lutra*, presenting less of the primitive pattern than *P. valetoni*. The coronoid process is peculiar; it is very wide, rather short, the anterior and posterior borders straight and almost parallel until near the tip, where

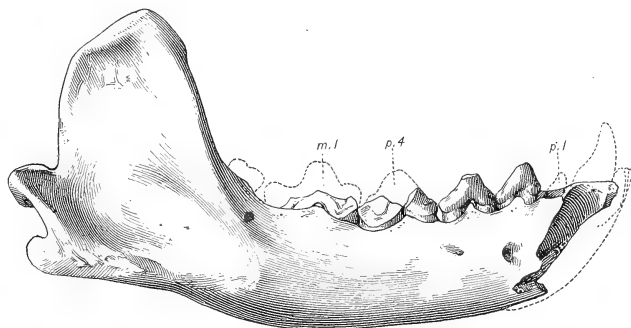


Fig. 6. *Potamotherium lacota*. Type jaw, No. 10810, external view.  $\times \frac{3}{4}$ .

they bend sharply towards each other to meet in a very blunt tip. The angle of the jaw is developed into a short, stout process, and the condyle is wide and rather heavy.

The relative sizes of the above species of *Potamotherium* are indicated by the following:

	<i>P. valetoni</i> .	<i>P. robustum</i> .	<i>P. lycopotamicum</i> .	<i>P. lacota</i> .
Length of $p_1-m_2$ ,	32	35	22	52

The measurements of the type of *P. lacota* are:

Length of jaw, condyle to anterior border of canine alveolus, 109.

Length of  $p_1-m_3$ , 60.;  $p_1-4$ , 36.

Depth of jaw beneath  $p_3$ , 21.; beneath  $m_2$ , 23.; at coronoid process, 50.

$P_2$ , antero-posterior, 9.; transverse, 4.

$P_3$ , " 10.; " 5.

$P_4$ , " 13.; " 6.5.

$M_1$ , " 18.5; " 7.

Alveolus of  $m_2$ , 6.5.

From the Upper Miocene (Loup Fork) of Little White River, S. Dakota.

*Lutra* Brisson.

The occurrence of a modern genus in the Loup Fork is a matter of some interest, as very few still existing genera are recorded from the American Miocene, and in most cases the determinations are questionable, based on inadequate types or specimens whose true horizon is not certain. The European Miocene contains a much larger proportion of living genera, although to some of these, no doubt, the same criticism of inadequate types or uncertain horizon would also apply. The species described below is nearer to the modern otter than is *Lutra dubia* of the Middle and Upper Miocene of Europe, so far as we can judge from the fragmentary material referred to that species by deBlainville, Newton, Depéret, and Hoffmann, but shows some peculiarities that throw it a little out of the direct line of descent.

*Lutra pristina*, sp. nov.

The type is a very perfect lower jaw (No. 10811) from the quarry at the Cañon of the Little White River, S. Dakota. It is considerably larger and more robust than *L. canadensis*, the carnassial has a nar-

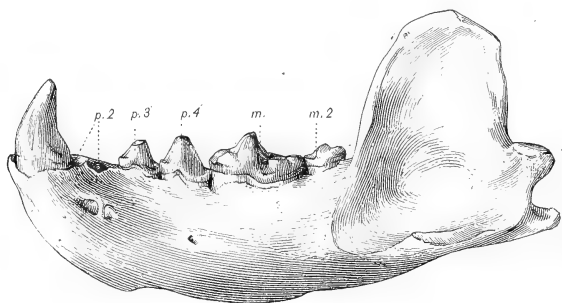


Fig. 7. *Lutra pristina*: Type jaw, No. 10811, external view.  $\times \frac{3}{4}$ .

rower trigonid with higher  $pa^d$  and  $pr^d$ ,  $me^d$  less widely separated and somewhat more posterior in position, the heel broader and more basin-shaped, with stronger internal ridge, lower  $hy^d$ , and distinct  $hl^d$ .  $M_2$  is of proportionately larger size, the surface flatter, the cusps lower, the outline more regularly circular. The heels of the premolars are narrower than in *L. canadensis*, with a well-defined cingulum, but

no heel-cusp. The angle of the jaw is produced into a short stout process, absent in the modern species; the coronoid process is much wider, especially towards the tip, and directed more backward. The muscular attachments are marked by much stronger ridges and rugosities.

The carnassial is larger and wider than in *L. dubia*, with a much broader heel. The metaconid appears to be somewhat more separated, and the paraconid-protoconid shear lower.

#### *Dimensions.*

Length of jaw from incisive alveoli to condyle, 103.

Depth of jaw beneath  $p_3$ , 22.; beneath  $m_2$ , 22.; at coronoid process, 44.

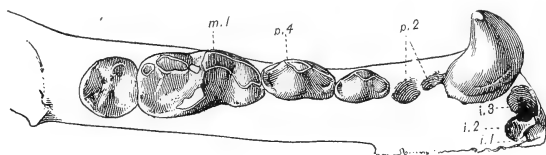


Fig. 8. *Lutra pristina*. Type. Crown view of teeth, natural size.

Length of entire dentition, incisive alveoli to  $m_2$ , 63.

" " premolar-molar dentition  $p_2$ - $m_2$ , 48.

$C_1$ , antero-posterior diameter, 10.; transverse, 8.

$P_3$ , " " 8.; " 4.

$P_4$ , " " 10.; " 6.

$M_1$ , " " 17.; " 9.

$M_2$ , " " 8.; " 8.

#### CASTORIDÆ.

##### *Steneofiber pansus* Cope.

This species was founded on associated upper and lower jaws, et cetera, from the "Loup Fork" (Miocene) of New Mexico. The dentition is as primitive and the size as small as in any of the Oligocene species; it was a matter for surprise, therefore, to find it in a late Miocene formation. No additional specimens had hitherto been discovered, but we are now able to describe a well-preserved skull and jaws from the sandy clay formation (Rosebud Beds), which underlies the true Loup Fork and overlies the White River on the Rosebud Reservation. This formation contains *Merychys* [July, 1904.]

and *Merycochærus*, ? *Eporeodon*, *Meniscomys*, and some indeterminate forms, and is provisionally referred to the Lower Miocene. We suspect from certain allusions in Professor Cope's descriptions that the type of *S. pansus* may also have been derived, along with "*Eumys*" *loxodon*, from a similar formation underlying the normal "Loup Fork" (Upper Miocene) of New Mexico.

Cope distinguished *S. pansus* by the form and relative size of the molars and the simplicity of the molar pattern. All these characters change greatly with the wear of the teeth, the patterns of the crowns becoming more simple by disappearance of the less deeply impressed enamel inflections, the premolars increasing in size, while the molars increase in transverse, but decrease more rapidly in antero-posterior diameter. The type of *S. nebrascensis* Leidy is a young adult, the type of *S. pansus* Cope is an old individual. A skull from the White River formation (Protoceras Beds), Am. Mus. No. 1428, described by Matthew in 1902, agrees in skull-characters with Leidy's type, and comes from the same horizon and locality; but its teeth are much more worn, and these show the proportions and pattern ascribed by Cope to his *S. pansus*. The skull we describe here, on the other hand, is that of a young adult, and has the tooth-characters shown in Leidy's figure of *S. nebrascensis*; we refer it to *S. pansus*, however, as it has the large bulla of Cope's type, agrees in size, comes probably from about the same horizon (Lower Miocene), and the difference in the relative size and pattern of the teeth is exactly what we should expect to find in view of the difference in their wear.

The skull is well distinguished from any of the described species by its extreme width and shortness. The width across the arches nearly equals the entire length of the skull. The zygomatic arch is very deep, except at the posterior end, and the occiput is very wide and low. The muzzle is short and small, the nasals much reduced in length, the basicranial region short, the bullæ set more transversely than longitudinally, the basioccipital moderately excavated, without median ridge. The palate is roofed over as far back as the anterior



border of the third true molar. The postorbital constriction is moderate; the temporal crests approximate a little behind it and finally unite to form a very low sagittal crest. The paroccipital processes are either broken off or were altogether absent, and the exoccipital bones appear much reduced in width lateral to the condyles. The mastoid portion of the squamosal has a very wide exposure, forming most of the lateral border of the occiput, as in *Castor*, but its inner border is not so much covered up by the occipital bones. The mastoid process is short and small. In *S.*

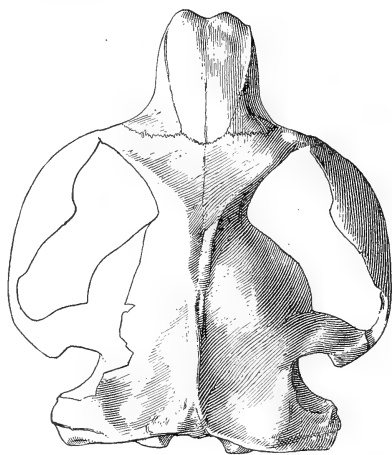


Fig. 9. *Steneofiber pansus*, No. 10818. Top view of skull, natural size. Rosebud beds (Lower Miocene), South Dakota.

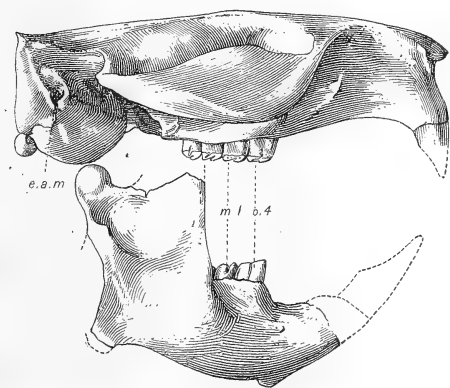


Fig. 10. *Steneofiber pansus*, No. 10818. Skull and jaw, natural size, right side view.

*nebrascensis* and in the type of *S. peninsulatus* the paroccipital processes are less reduced and the mastoid exposure smaller and less prominent. In the short bulbous nasals this species approaches *Castor* rather than *Steneofiber*; the deep zygoma is seen in *Castor* and likewise in *S. peninsulatus*, but in neither is it developed to so great an extent. In most other characters *S. pansus* shows a divergent specialization if we take *S. nebrascensis* as the most primitive member of the genus. The extreme width and flatness of the skull suggest analogy with the sewellel (*Haplodontia*), but there is

really little resemblance between the skulls except in general proportions.

The lower jaw is about as deep as that of *S. peninsulatus*, figured by Cope, with much shorter diastema behind the incisors, smaller molar-premolar series, and coronoid process directed more vertically. The conformation of the angle is somewhat different from that of *Castor*, the border more strongly inflected anteriorly, the pterygoid fossa more deeply excavated; but the posterior border is incomplete, and the extent of the difference from *Castor* cannot be stated.

COMPARATIVE MEASUREMENTS OF SPECIES OF *Steneofiber* and *Castor*.

	<i>Steneofiber pansus</i> . Am. Mus. No. 10818.	<i>Steneofiber peninsulatus</i> Type.	<i>Steneofiber nebrascensis</i> . Am. Mus. No. 1428.	<i>Steneofiber gradatus</i> . Am. Mus. No. 7008.	<i>Steneofiber aseri</i> (from Filhol's figures.)	<i>Castor canadensis</i> . Am. Mus. No. 2029.
SKULL.						
Total length of incisors to condyles....	57.5	70.2	62.	53.	80.	141
Width across zygomatic arches.....	52.	49.			52.	99.
"    of occiput.....	36.5	31.	24.3		36.	66.
Height of occiput.....	16.2	22.	17.		20.3	41.
Length of nasals.....	18.8	25 +			31.	48.
Width of muzzle.....	13.5	17.	12.5	12.7	15.	32.
Depth ".....	12.4	12.			17.	37.
Width at postorbital constriction.....	11.	7.		7.5	12.	26.
Depth ".....	20.	23.5		21.7	27.6	60.
Length of diastema behind incisors....	19.	23.	22.	16.	29.	47.
Length from posterior border of palate to condyles.....	25.	32.	25 ±	24.5	34.	52.
Width of palate including molars.....	16.	18.	16.2	15.	21.	37.
Length of grinding series (at base of ex- posed crowns).....	12.1	14.1	13.	12.	18.	33.
Transverse diameter of incisor.....	4.	4.		3.2		8.2
Length of muzzle inferiorly from pos- terior border of premaxillæ.....	15.1	19.5	15.5		19.	44.
LOWER JAW.						
Length from condyles to base of in- cisors.....	42.4				55.	105.
Length of diastema behind incisors....	7.	11.			14.	24.
"    lower grinding series at base of exposed crowns.....	14.1	15.			20.	37.

**Dipoides** *fäger*.

Syn. *Eucastor* Leidy, ? *Sigmogomphius* Merriam.

Dr. Schlosser's excellent figures and descriptions of *Dipoides* make it clear that the pattern of the molar teeth is the same as in *Eucastor* and *Sigmogomphius*, namely, one external and one internal inflection of the enamel. In *Sigmogomphius* there are but three upper teeth, according to Dr. Merriam's description, but his words imply some uncertainty as to the normal absence of  $m^3$ .<sup>1</sup> He distinguishes *Sigmogomphius* from *Eucastor* by the pattern consisting of inflections instead of isolated enamel lakes, but this is an age character, as Leidy's specimen "belonged to a quite aged animal, as indicated by the condition of the molar teeth, which are nearly worn away to the fangs,"<sup>2</sup> and in consequence all the enamel inflections were converted into isolated lakes before their disappearance, as in other Castoridae. *Eucastor* certainly had four teeth in each jaw, as indicated by Leidy<sup>3</sup> and shown by all our specimens. It appears, therefore, that there are no generic characters to separate it from *Dipoides*, to which Schlosser has already remarked its resemblance in pattern.<sup>4</sup>

**Dipoides tortus** (*Leidy*).

Three lower jaws agree in size with this species. One is almost complete, and affords some interesting comparisons with *Steneofiber* and *Castor*.

The jaw is longer anteriorly than in these genera, the incisor more horizontal in direction, considerably less robust, with convex anterior face (nearly flat in *Steneofiber* and *Castor*) and the tip drawn to a much more slender chisel-edge than in the true beavers. The descending process at the posterior end of the symphysis is quite small, and the jaw is not so

<sup>1</sup> "As the number of molars is one of the important characters of the genus, it should perhaps be stated that, although the head bones extend backward beyond the molars, no sign of a fourth tooth could be found on either side." — Bull. Dept. Geol. Univ. Cal., Vol. I, p. 365, March, 1896.

<sup>2</sup> Ext. Mam. Faun. D. and N., p. 341.

<sup>3</sup> *Ibid.*, p. 342, measurements.

<sup>4</sup> Fossilen Säugethiere China's, p. 42 and figures; also Beitr. z. Kennt. Säugethierreste aus den Süddeutschen Böhnerzen, p. 22 and figures.

deep at this point nor the symphysial angle so abrupt. The internal inflection of the angular border of the jaw is very marked, especially at its anterior end just behind the grinding series, and the pterygoid fossa is very deeply excavated; but the angle is not produced backwards like that of *Castor*, so that the outline of this part is decidedly peculiar. Unfortunately the posterior border of the angle is incomplete, so that we cannot decide whether it was produced as in *Haplo-*

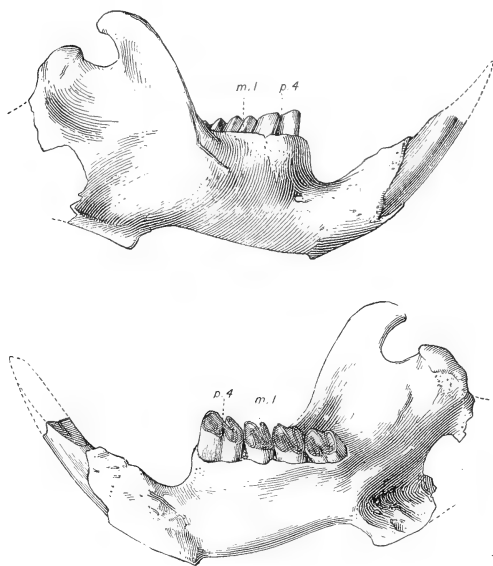


Fig. 11. *Dipoides tortus* (Leidy). Lower jaw, natural size, outer and inner aspect. No. 10821, Loup Fork beds, South Dakota.

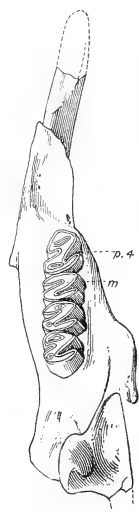


Fig. 12. *Dipoides tortus* (Leidy). Lower jaw, from above, natural size. No. 10821.

*dontia* into a stout process projecting externally; but the parts preserved correspond more nearly with that genus than with any other living rodents. *Steneofiber pansus* exhibits the same peculiar form much less developed, as does also *S. viciacensis* to some extent, according to Filhol's figures; but in both, unfortunately, the posterior border of the angle is defective. [This may be associated with widening and flattening of the back of the skull, necessitating a different development of the pterygoid muscles from that which pre-

vails in the longer-skulled *Castor*; if so it would involve notable difference in the form of the skull between *Dipoides* and *Castor*.]

#### HAPLODONTIIDÆ.

##### **Meniscomys**, sp. indet.

A lower jaw (No. 10824), with the three true molars and part of the alveolus of the fourth premolar, represents this John Day genus in the Rosebud Beds, associated with *Steneofiber pansus*, *Merychyus*, *Merycochaerus*, etc. The three teeth preserved agree well in size and pattern with *M. hippodus* Cope. The small part of the premolar alveole preserved indicates a large tooth, but not enough to show its actual size or form, so that we do not venture to refer it to that species. The occurrence of the genus is of interest, as it has hitherto been limited to the John Day Basin, occurring in the middle and upper levels of the John Day formation, according to Merriam.

Lower Miocene (Rosebud formation), Little White River, S. Dakota.

The dentition of *Meniscomys* has a strong resemblance to that of *Haplodontia*, as was remarked by Professor Cope,<sup>1</sup> and may be observed in the accompanying diagram. The most marked feature is the high straight external wall (ectoloph) of the upper molars, with sharp prominent median-external buttress (mesostyle), and the corresponding internal wall and buttress of the lower molars. In *Meniscomys* the molars are less hypsodont and the intermediate cusps (paraconule and metaconule) are distinct; in *Haplodontia* the paraconule and metaconule are converted into crests uniting protocone and ectoloph, the posterior and anterior cingula elevated, and the intermediate valleys converted into isolated lakes, which disappear on further wear of the tooth. The relations of the two genera may be about the same as those of *Steneofiber* and *Castor*. It seems advisable, therefore, to

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<sup>1</sup> Tertiary Vertebrata, p. 827.

place *Meniscomys* with the Haplodontiidae rather than with the Sciuridae, for its teeth differ very considerably from those of any genus of Sciurids. The genus *Mylagaulodon* Sinclair appears to be related to *Meniscomys* and *Haplodontia*, but we are unable to trace any relationship to *Mylagaulus*, whose teeth in our opinion are derived from a Castorid or Hystricomorph pattern, with quadrate  $p^4$  and no  $p^3$ . *Meniscomys*, *Mylagaulodon*, and *Haplodontia* have, like the Sciuridae, a tri-

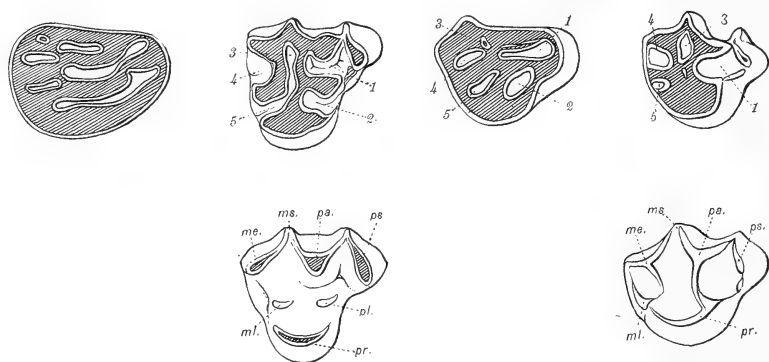


Fig. 13. Fourth Upper Premolar in Mylagaulidae and Haplodontiidae.

*Mylagaulus*  
Middle Miocene  
(Amer. Mus. Coll.)

*Meniscomys*  
Upper Oligocene  
(Amer. Mus. Coll.)

*Mylagaulodon*  
Lower Miocene  
(After Sinclair)

*Haplodontia*  
Recent  
(Amer. Mus. Coll.)

The numbers refer to corresponding enamel lakes in teeth moderately worn; the letters to corresponding cusps in the unworn teeth. Osborn's molar cusp nomenclature is used as a matter of convenience, not necessarily implying homology with the cusps of the true molars.

angular  $p^4$ , and  $p^3$  very persistent although small. The molar pattern in Haplodontiidae and Sciuridae is clearly derived from the primitive tritubercular one; in the latter family it is but little altered, and in the former the process of change parallels in some respects the evolution of the teeth in the Equidae. In Castoridae and most of the Hystricomorphs the tritubercular derivation of the molar pattern is hardly recognizable; the teeth are quadrate with oblique enamel inflections, normally three external and one internal in the upper, three internal and one external in the lower molars. In Mylagaulidae these oblique inflections are converted into mostly longitudinal lakes, and in the fourth pre-

molar the number of lakes is increased apparently by successive additional crests arising from the cingulum; while the true molars tend to reduction and disappearance.

#### MYLAGAULIDÆ.

##### ***Mylagaulus monodon* Cope.**

Four specimens referred to this species were obtained in the Loup Fork sands at Big Spring Cañon on the Little White River. Two were unfortunately lost in the field or in unpacking the collection, and the others do not add much to the morphology of the species.

#### III. DICOTYLIDÆ.

##### ***Prosthennops*, gen. nov.**

*Generic Characters.* — Incisors vestigial; canines elliptical in cross-section, more recurved than in *Tagassu*; premolars less completely molariform than in *Mylohyus* (or *Tagassu* ?); muzzle anterior to premolars more elongate than in *Tagassu*, but less so than in *Mylohyus*; malar bones expanded transversely into massive tuberosities; orbits placed well back, being directly over the glenoid fossæ.

A complete and finely preserved peccary skull (No. 10882 Amer. Mus. Coll.), found by J. W. Gidley in the Loup Fork sands, indicates that the so-called *Dicotyles* of the Upper Miocene is quite distinct from the modern genus, as well as from the Pleistocene peccaries, *Platygonus* and *Mylohyus*. This distinction appears to have been suspected by Cope, for the type specimen of his *Dicotyles serus* (a lower jaw from the Upper Miocene of Kansas) bears the label "*Prosthennops serus*." We adopt Cope's manuscript name for the genus.

##### ***Prosthennops crassigenis*, sp. nov.**

*Specific Characters.* — Premolars much smaller than the molars;  $p^3$  triangular, three-rooted;  $p^3$  and  $p^4$  four-rooted, but not completely molariform as indicated by the close approximation of the two inner fangs; the palatines extend well backward, throwing the posterior nares somewhat behind the glenoid fossæ; the bullæ are large and occupy a more posterior position than in any species of *Tagassu*; the ridge on the outer surface of the maxilla is not produced forward as in the modern peccaries, but is short and bifurcated anteriorly by a deep

pit. Anterior to this pit is another larger pit in which the infraorbital foramen opens; still another shallower pit of smaller size occupies a position anterior to and somewhat above the large pit. There are also two long, narrow pits or grooves on the upper face of the skull, extending the entire length of the nasals. The sagittal crest is broad

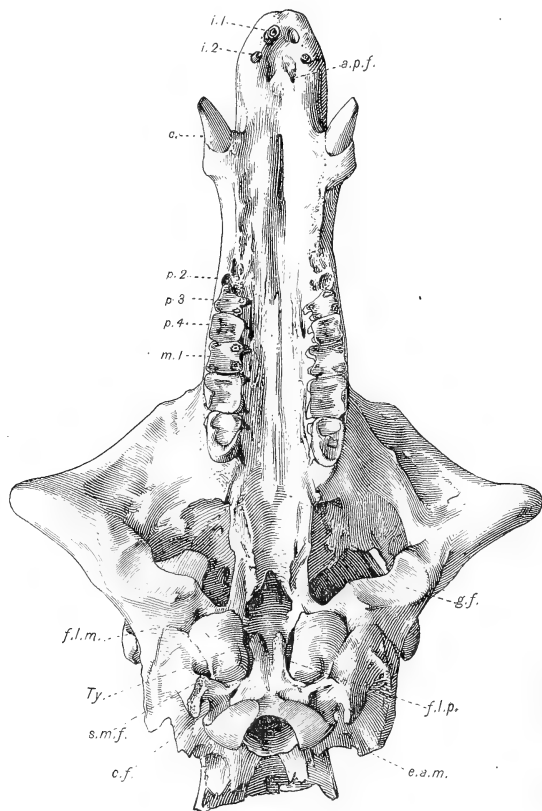


Fig. 14. *Prosthennops crassigenis*. Skull, palatal view, one third natural size. Type, No. 10882, Loup Fork beds, South Dakota.

and flat on top. Some of the above specific characters may prove to be of generic value.

#### Measurements.

Length of dental series $m^3$ to $i_1$ inclusive.....	175 mm.
"    "    molar-premolar series.....	80 "
"    "    molar series.....	50 "
"    "    diastema between $p^2$ and canine.....	50 "
Total length of skull.....	295 "
"    width    "    "    across malar bones.....	215 "



The primitive Suidæ, common to both hemispheres in the Oligocene, gave rise in the New World to the Dicotylinæ<sup>1</sup> and in the Old World to the true pigs (Suinæ). These two sub-families became separated as early as the beginning of the Miocene. Since that time the Suinæ have been confined entirely to the Old World, while the Dicotylinæ branch continued on in the New World, and is to-day represented by a single living genus *Dicotyles*. No representative of the sub-family Dicotylinæ has ever been found in the Old World.

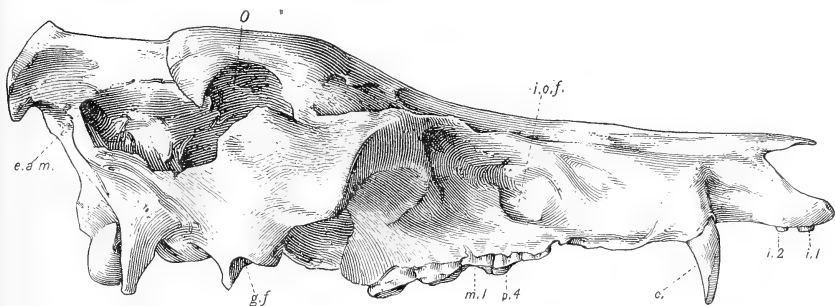


Fig. 15. *Prosthennops crassigenis*. Skull, side view, one third natural size. Type specimen.

Many extinct American species have formerly been referred to the genus *Dicotyles* by various authors, but it now appears that most of these species belong to other genera.

The recognizable genera of the Dicotylinæ are briefly distinguished according to their upper teeth and skull characters as follows. Their known distribution is also given below.

### **Tagassu Frisch.**

*Dicotyles* CUVIER.

*Distribution.* — Tropical America, ranging as far north as Texas.  
*Horizon.* — Pleistocene to present time.

*Characters.* — Three upper premolars;  $p^4$  molariform;  $p^2$  and  $p^3$  more or less molariform; molars low crowned with distinct cusps, but tending to become multicuspid; canines nearly straight and somewhat triangular in cross-section; incisors two in number, inner pair much the stronger; diastema between  $p^2$  and  $c$  about equalling the premolar series of teeth in length.

<sup>1</sup> Properly, *Tagassuidæ* Palmer, 1904.

**Mylohyus** Cope.

*Known Distribution.* — Eastern and middle-western United States.  
*Horizon.* — Pleistocene.

*Characters.* — Three upper premolars;  $p^3$  and  $p^4$  completely molariform;  $p^2$  usually four-rooted; form of canines not known; molars quadricuspid; incisors vestigial or wanting; muzzle anterior to premolars very long, diastema between  $p^2$  and  $c$  twice the length of premolar series.

**Platigonus** Le Conte.

*Distribution.* — Greater portion of the United States. *Horizon.* — (?) Upper Miocene, Pliocene, and Pleistocene.

*Characters.* — Three upper premolars which are all simple, two or one principal cusp; molar crowns higher than in *Tagassu* and composed of two more or less well-defined transverse crests; basal cingulum in both molars and premolars strongly developed; length of diastema between  $p^2$  and  $c$  but little greater than length of premolar series.

**Prosthennops** Matthew and Gidley.

*Distribution.* — South Dakota, Nebraska, and probably western United States in general. *Horizon.* — Upper Miocene.

*Characters.* — Three upper premolars all smaller than molars, less progressive than in *Mylohyus*; canines small and more curved than in *Tagassu*; incisors vestigial; muzzle in front of premolars somewhat longer than in *Tagassu*, but much shorter than in *Mylohyus*; diastema between  $p^2$  and  $c$  about one and three sevenths the length of the premolar series; molars tending to become multicuspid; malar bones developed into widely expanded massive tuberosities.

The foregoing genera are readily distinguishable from *Perchærus* and other Oligocene genera, in which the teeth are all more primitive. In *Perchærus*  $p^1$  is usually present, and all three incisors are strongly developed. The muzzle is short, there being little or no spacing between the forward teeth. Molars are always simple quadricuspid, premolars bicuspid and never molariform. In the later Dicotylinæ the premolars became successively molariform (*cf.* *Perissodactyls*), showing in the different genera various stages of molarization as was observed by Cope.

Article XXIII. — ANTS FROM CATALINA ISLAND,  
CALIFORNIA.

By WILLIAM MORTON WHEELER.

The following eight species of Formicidæ were collected on Catalina Island, California, during the spring of 1904, by Prof. C. F. Baker of Pomona College, California. Half of these belong to well-known forms from the adjacent mainland, while the other half exhibit certain peculiarities probably of geographical significance.

1. *Monomorium minutum ergatogyna* subsp. nov.

I base this subspecies on numerous workers and eight females taken from three different nests. The workers are merely somewhat smaller (1.5 mm.) than the common var. *minimum* Buckley, which is known to occur throughout the United States as far north as Massachusetts and Illinois. All the females, however, are ergatoid, *i. e.*, they show no traces of having had wings; they are smaller (only 3.25–3.5 mm.) and have somewhat smaller eyes and more slender thoraces than the winged females of the typical form. The latter measure 4–5 mm. in length. I am led to believe that these females may represent an adaptation to life on an oceanic island. Recently I have received from Mrs. Annie Trumbull Slosson several specimens of a form of *M. floricola* Jerdon collected at Biscayne Bay, Florida. Among these I find three ergatoid females, all from the same nest and similar in structure to those of *M. ergatogyna*.

2. *Solenopsis texana catalinæ* subsp. nov.

Several workers and dealated females hardly differing from the typical pale Texan form except in the more uniform coloration. There is no infuscation of the gastric segments. The pilosity of the worker is sparser and somewhat less conspicuous. The nodes of the pedicel are of very nearly equal breadth. In the female the node of the petiole is decidedly

more compressed anteroposteriorly, and the greatest width of this segment seen from above is behind the middle instead of at the middle as in the female of the typical *texana*. The postpetiole of this sex in *catalinæ* is also shorter and its anterior angles much sharper.

3. ***Pheidole hyatti* Emery.** Soldiers and workers from four nests, and all belonging to the typical yellow Californian form.

4. ***Crematogaster lineolata coarctata* Emery.** Several workers indistinguishable from the typical form from California.

5. ***Stenamma* (*Aphænogaster*) *patruele bakeri* subsp. nov.**

Workers from two colonies. Whole ant shining, the sculpture on the head being confined to rather irregular longitudinal rugæ on the anterior two-thirds, with very indistinct interrugal sculpture. Upper surface of thorax glabrous, meso- and metapleuræ longitudinally, basal surface of epinotum transversely, wrinkled. Ventral portions of petiole and postpetiole punctate. Pro- and mesothorax convex, hemispherical, basal surface of epinotum evenly convex in profile. Epinotal spines very small, acute, much further apart than long. Whole body yellow or yellowish red, except the following portions: there is a large brown blotch on the vertex; the inner borders of the mandibles, the summits of the nodes of the pedicel, the gaster with the exception of the incisures, and in some specimens also the middle portions of the femora and tibiæ, are more or less infuscated.

Forel and Emery regard *patruele*, which was originally described from the island of Guadalupe, off the coast of California, as a subspecies of *S. subterraneum*, but I am inclined to separate it as a distinct species on account of the striking difference in the shape of the thorax. In *subterraneum* and its western form *occidentale* Emery, the pro- and mesothorax are much less hemispherical, and the basal surface of the epinotum is straight or even somewhat concave in profile. There seem to be several forms of *subterraneum* in the Western States, so that it will be an advantage to separate out *patruele*, although we may still regard it as belonging to the *subterraneum* group. The new subspecies is very striking on account of its glabrous surface, yellow color, and the conspicuous blotch on the head.

6. **Stenamma (Messor) andrei** Mayr. A single worker of the typical form, which appears to be rather common in California and Nevada.

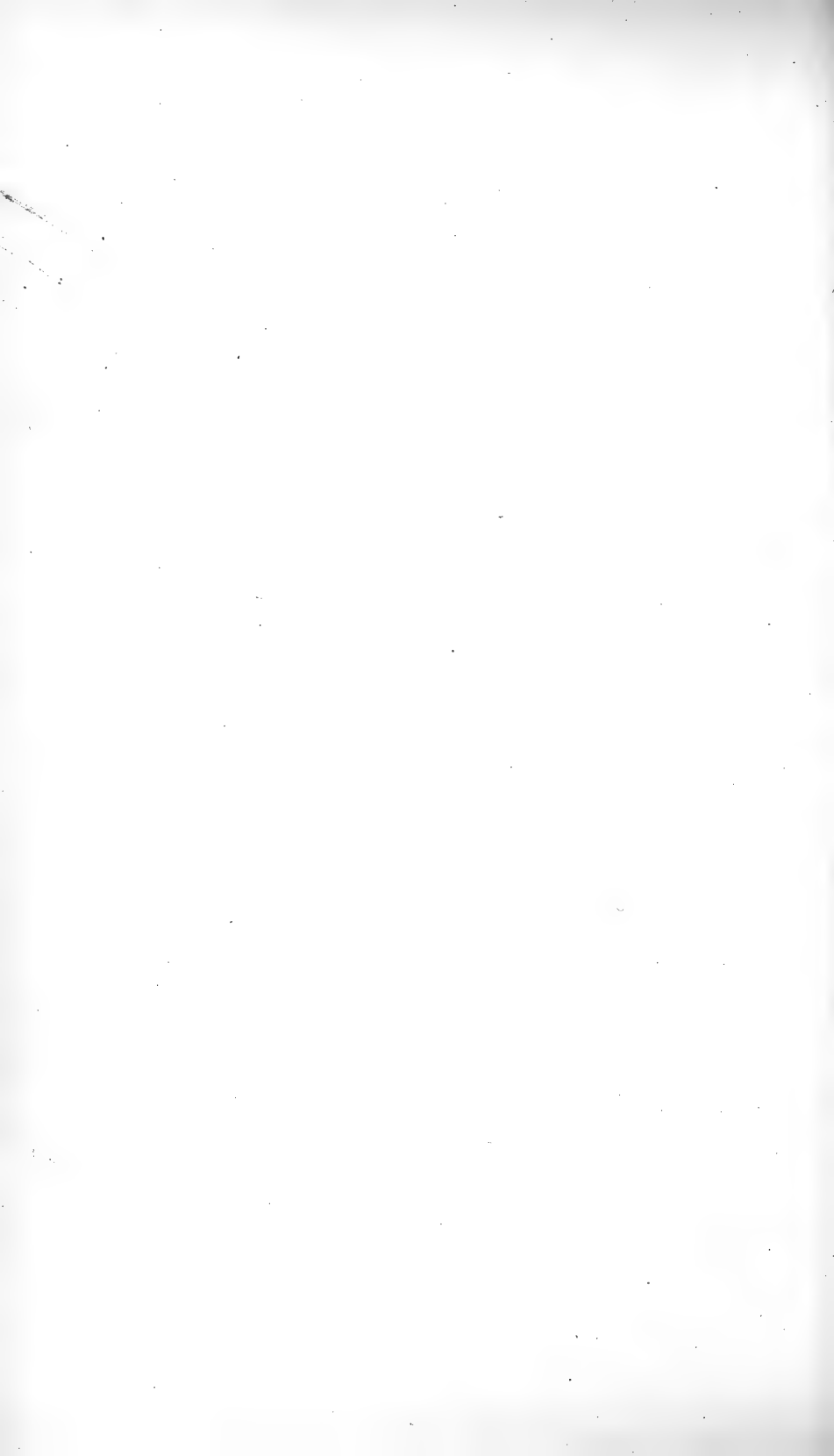
7. **Camponotus maculatus vicinus** Mayr var. **nitidiventris** Emery. One soldier and four workers.

8. **Camponotus hyatti** Emery var. **bakeri** var. nov.

*Media*. Length: 5.5 mm. Differing from the typical form in coloration, which is like that of *C. marginatus* Latr. var. *discolor* Buckley except that the basal two thirds of the first gastric segment are also red like the head, thorax, and appendages. The sculpture is quite as sharp as in *marginatus*, and the surface of the body and head quite as opaque. The mandibles and cheeks are coarsely punctate. In profile the thorax is like that of the typical *hyatti* except that the basal surface of the epinotum has a transverse impression behind.

*Female*. Length: 7.5–8 mm. Resembling the female of *C. marginatus* var. *discolor*. Head longer than wide, with nearly straight posterior border and prominent posterior angles; cheeks converging in front, distinctly concave. Mandibles 5-toothed. Whole body more shining than in *discolor*, though it is throughout distinctly shagreened. Mandibles, cheeks, and front coarsely punctate. Body and appendages yellowish red, teeth of mandibles, anterior border of clypeus and cheeks, scutellum, mesonotum, a narrow band across the posterior portions of the first and second gastric segments and the remainder of the gaster, black. All the gastric segments are edged with yellow. There is a more or less distinct brown cloud on the anteromedian, and in some specimens also on the lateral surface, of the mesonotum. Wings yellowish gray with brownish yellow veins.

Described from two mediæ and two female specimens.



**Article XXIV.—MAMMALS COLLECTED IN ALASKA BY  
THE ANDREW J. STONE EXPEDITION OF 1903.**

By J. A. ALLEN.

The mammals obtained by the Andrew J. Stone Expedition of 1903 number 873, including about 30 large mammals (moose, sheep, bears, etc.), and represent 28 species. About 140 specimens were collected on the Bering Sea side of the Alaska Peninsula, near Muller Bay (Port Muller of most maps), and the remainder on the Kenai Peninsula, principally near Seldovia. A few bear skulls were obtained on Kadiak Island.

Mr. Stone, with his two assistants, Messrs. Malcolm P. Anderson and Belmore H. Browne, who also accompanied him in 1902, left Seattle, April 24, and after a sea voyage of about twenty days reached Sand Point, Alaska, May 14. Two hunters were engaged at Unga Island, and the head of Portage Bay was reached on the night of May 15. The next day the party (five men in all) began to transport their supplies over the portage to Herendeen Bay, this arduous work occupying four days; the snow being deep and in places soft, the work proved difficult and exceedingly fatiguing. On May 23 the first hunting camp was established, well up on Muller Bay, for the purpose of obtaining a series of the large brown bears which inhabit the Alaska Peninsula west of the tree line. The first bear was secured on the 24th, a fine large female, with two cubs, one of which was secured alive and sent to the New York Zoölogical Society, and is still (July, 1904) living in the Society's Garden. The next, a fine old male *Ursus dalli gyas*, was killed on the 29th, the skin and entire skeleton being preserved; it proved to be one of the largest bears ever taken on the Alaska Peninsula, its approximate weight being 1600 pounds. By the evening of June 12 ten fine specimens had been obtained, seven of which were fully adult; nine others were seen. This ended the bear hunt, and preparations were immediately made to return to Sand Point, which was reached on the evening of June 18.

Mr. Anderson had in the meantime devoted himself to the collecting of small mammals, of which he obtained six species, including a good series of topotypes of *Citellus stonei*.

On June 21 the party left Sand Point for Kadiak Island and Cook Inlet. A short stop was made at Kadiak Island on June 24, and Seldovia was reached the next day; on the 26th the collecting of small mammals and birds was begun and prosecuted vigorously at this point till August 3. A little collecting was done at Barabari, near Homer, August 6-8, when the work was transferred to Sheep Camp, on Sheep Creek, and continued there till September 9, and later at Upper Sheep Camp, September 12-21, and at Moose Camp from September 25 to October 8.

In order to obtain sheep, moose, and caribou it was necessary to establish a series of camps during August at suitable localities for the fall hunt for these animals, in locating and preparing which Mr. Stone was greatly indebted to the voluntary services of Mr. John Gillpatrick, "sailor and hunter," of whose efficiency Mr. Stone speaks in his report in the highest terms. On August 3 Mr. Stone, with his two assistants, three Indian helpers, and Mr. Gillpatrick, left Seldovia with the supplies for these camps, which were most judiciously selected, as shown by the results of the fall hunt—3 bears, 16 white sheep, and 6 moose, all in good fall pelage, which were preserved with special care for mounting as groups. Also several hundred small mammals and many birds were obtained at these camps. The hunt for caribou, however, proved a failure, the small band of *Rangifer stonei* supposed to be yet ranging in the Caribou Hills having crossed the country into the mountains seat of Kussilluf Lake, about twenty-five miles from their old range. Seldovia was reached on the return trip, October 10, with the camp outfit and specimens, thus ending a very successful season's work.

The following brief account of the principal localities at which collections were made is compiled from Mr. Anderson's field notes.

*Herendeen Bay and Muller Bay, Alaska Peninsula*, May 19-June 13.—At Herendeen Bay, May 19, "the vegetation was



just beginning to feel the effects of spring. The long grass that covers the hills was dead and matted down. The alders, which form almost the only ligneous vegetation, were just beginning to show their leaf buds. At Muller Bay, which we reached on May 22, conditions were much the same; but before we left there on June 13, new grass was beginning to show beneath the old, and the alders were in blossom."

*Seldovia*, June 26–August 3.—Seldovia is near the southwestern point of the Kenai Peninsula. "Here the hills are forested with spruce, with here and there a small grove of poplars. The woods are open in but few places, there being for the most part an undergrowth of alder bushes, devil club, salmonberry, and other plants that are less conspicuous."

*Sheep Camp, Sheep Creek*, August.—At "our upper camp on Sheep Creek, I found conditions somewhat different from those existing at Seldovia. The woods here are decidedly mixed; poplars and birches intermingle with spruces, and in the bottomland of Sheep Creek, as well as on the hillsides, there are large patches of alder bushes and willows."

*Caribou Camp*, September 3–9.—This camp was at timberline, and "the bare hilltops and grassy hillsides afforded a new kind of field for trapping. . . . In ascending the mountains above timberline, one passes through a belt of alders and comes out upon a comparatively level, very open country, which rises gradually and finally merges into the actual mountains. This 'level' country is cut up into little hills and hollows. The hilltops are covered with a dense mat of vegetation composed largely of 'spruceberry' (black crowberry) bushes, cranberry and blueberry bushes, and several forms of moss and lichen. The hollows and valleys have deeper soil, with grass and various other herbaceous plants."

*Moose Camp*, September 25–October 8.—Also at timberline. "Here, where the spruce forest ends, a region of tall grass and patches of alders begins."

The fauna of the western end of the Alaska Peninsula is of course very different from that of the Kenai Peninsula, only three of the species found near Muller Bay being taken on

the Kenai Peninsula, namely, *Marmota caligata*, *Microtus operarius*, and *Sorex personatus*.

This is the third and last of the series of expeditions to Alaska and northern British Columbia, organized under the leadership of Mr. Andrew J. Stone, to secure Arctic mammals and birds for this Museum. The means for this enterprise were provided in 1901 by friends of the Museum (see this Bulletin, XVI, 1902, p. 215), and the generous supporters of this work have every reason to feel gratified with the results. The Museum has by this means been placed in possession of the finest series of the large game animals of subarctic America anywhere extant, besides several thousands of small mammals, representing abundantly nearly all the species of the regions visited. Material of the best character has been provided for groups of the big Alaska Brown Bear, Alaska Black Bear, Alaska Grizzly, the big Alaska Moose, two species of Caribou, two species of Mountain Sheep, the Mountain Goat, and the Sitka Deer. Among the smaller mammals several new species were discovered, others previously little known have been secured in large series, and the large number of birds obtained has greatly enriched our ornithological collection.

1. **Alce<sup>1</sup> gigas Miller.** ALASKA MOOSE.—Six specimens, including three adult males, an adult female, a two-year-old male, and a male calf, taken in the rolling hilly country north of Chugachik Bay, Sept. 25–Oct. 2. This series includes “one of the largest and finest bulls ever secured on the Peninsula,” the whole forming as complete a group for mounting “as could be selected from a thousand.” They were prepared with special care, with a view to their use for this purpose.

2. **Rangifer stonei Allen.** STONE’S CARIBOU.—No speci-

<sup>1</sup>According to Dr. T. S. Palmer (Index Generum Mammalium, 1904, p. 86) *Alce*, as a generic name for the Old World moose (elk) dates from Frisch, 1775, thus antedating the form *Alces* of Gray (1821) and of later authors, and also Blumenbach’s use of *Alce* (1799) for the extinct Irish Elk (*Megaceros hibernicus* Owen, 1844). Hence *Paralces* Allen, 1902, is a synonym of *Alce* Frisch, 1775.

mens were obtained, although a week was spent in search for them in the Caribou Hills, near Seldovia, where a small band was supposed still to range. It was found later that they had gone across into the mountains to the east of Kussilluf Lake, about 25 miles from their old range.

3. ***Ovis dalli kenaiensis* Allen.** KENAI WHITE SHEEP.—Sixteen specimens—7 adult females, 4 adult and 1 young adult rams, and 2 male and 2 female lambs; also an additional head. The four adult rams were taken in the mountains at the head of Kussilluf Lake, by Mr. Herbert, Oct. 3–5, and the others in the Sheep Mountains, at the head of Sheep Creek, Sept. 11–20. No adult rams were met with during the Sheep Mountain hunt, and a special trip later of 400 miles' travel was made for old rams. Although the localities where the sheep were taken were only five miles apart, the point where the rams were obtained could be reached only by a circuitous journey of about 200 miles and return.

These specimens are in good fall pelage and furnish the long-desired material for a group, the specimens of this species obtained on previous expeditions having all been in the short summer coat.

4. ***Sciurus hudsonicus* Erxleben.** HUDSON BAY RED SQUIRREL.—Thirty-three specimens, taken as follows: Seldovia, 4, July 4–21; Sheep Creek, 20, Aug. 14–Sept. 1; Moose Camp, north of Chugachik Bay, 8, Sept. 28 and Oct. 2–7. They are thus nearly all in summer pelage, even the October specimens having acquired but little of the winter coat.

“The Red Squirrel is rather scarce in the woods at Seldovia. Although I saw the signs of several I did not secure any till some were brought in by natives during July.” On Sheep Creek they “were very common in the spruces, both in the valley and on the hills. On August 16 I shot a red squirrel from a large poplar. He was rapidly cutting the leaves from the tree, and upon examination I found that each leaf that he had cut bore an abnormal growth [gall], probably caused by the sting of an insect in laying its eggs. I opened

a number of these growths and found them filled with plant lice; one, however, had a large white larva in it. As there were many leaves on the poplar which did not have this abnormality, and as no leaves were cut which did not bear it (I examined a large number), the inference is that the squirrel desired these excrescences for food."—M. P. A.

5. ***Citellus stonei* Allen.** STONE'S GROUND SQUIRREL.—

*Citellus stonei* ALLEN, Bull. Am. Mus. Nat. Hist., XIX, 1903, pp. 533 and xvii, Oct. 10, 1904. Type locality, Stevana Flats, Alaska Peninsula; erroneously given in the original description as Wrangel, Alaska (corrected, *l. c.*, p. xvii).

Fifteen specimens (all practically topotypes), Alaska Peninsula, taken as follows: Herendeen Bay, 7, May 19 and 20; Muller Bay, 8, May 24–June 8.

The type was collected by Mr. Stone, in the hills north of Stevana Flats, June 7, 1902; the present series was taken in the same immediate region, and all within a distance of thirty miles along the coast at Muller Bay. They are all practically indistinguishable from the type, having been taken at the same season. The original description therefore requires no modification further than to add the measurements as taken by the collector from the fresh specimens, as follows: 5 males, total length, 361 (341–383—only one specimen above 365 and only one below 355); tail vertebræ, 94 (83–110); hind foot, 59 (56–63); ear, 15.4 (14–16): 10 females, total length, 333 (314–352); tail vertebræ, 86 (78–94); hind foot, 56 (54–57); ear, 13.7 (12–15).

Spermophiles, says Mr. Anderson, were living at Herendeen Bay "in the dryer portions of a valley which extends back from the head of the bay. In crossing from Portage Bay to the Bering Sea side of the peninsula a number were seen running about in the snow which then covered the higher parts of the trail. They were taken later at Muller Bay, where they had burrows in banks and hillsides."

6. ***Marmota caligata* (Eschscholtz).** HOARY MARMOT.—  
Seven skins and skulls and 3 additional skulls, Seldovia, July

17-28. A single barren female was taken at Muller Bay, where it had its burrow on a hill near the shore. No others were seen on the Alaska Peninsula, nor even signs of any. At Seldovia, where the specimens were obtained from natives, they were said to inhabit rocky hills at the head of the bay on which Seldovia is situated.

7. **Evotomys alascensis** Miller. ALASKA RED-BACKED VOLE.—Six specimens, Muller Bay, May 31-June 12

This species differs strikingly from *E. dawsoni* in its much lighter colors, the red of the back being very much paler and the sides much lighter, the ventral surface pure light gray, and the tail rusty buff all around instead of dusky above. It is about as much lighter than late spring specimens of *dawsoni* as the late spring pelage of *dawsoni* is lighter than the late summer pelage of *dawsoni*. *E. alascensis* also differs strongly in cranial characters from the *dawsoni* group.

The two males measured respectively in the flesh, total length, 144, 146; tail vertebræ, 32, 35; hind foot, 19, 20; ear, 13, 14. The 4 females are smaller: total length, 137.5 (134-140); tail vertebræ, 33 (30-35); hind foot, 19 (18.5-20); ear, 12.9 (12-13.5).

These specimens have been compared with six topotypes of *E. alascensis*, kindly loaned me by Dr. F. W. True, Head Curator of the Department of Biology, U. S. National Museum. They differ only in the coloration of the ventral surface, which in the Muller Bay (June) specimens is clear ashy white, and in the St. Michaels (October and November) specimens is more or less buffy, a difference clearly due to difference of season.

This species was apparently rare at Muller Bay, where persistent trapping yielded only six specimens.

8. **Evotomys dawsoni orca** (Merriam). ORCA RED-BACKED VOLE.—One hundred and forty-seven specimens, taken as follows: Seldovia, 45, June 27-July 31; Barabari, 8, Aug. 6, 8, and 28-30; Sheep Creek, 5, Aug. 21-25 and Sept. 12; Caribou Camp, 7, Sept. 3-9; Moose Camp, 82, Sept. 25-Oct.

8. Of this number only about 23, or about one sixth, are fully adult. These consist of 14 females and 9 males, and measure as follows: 9 males, total length, 143 (140-149); tail vertebræ, 35 (32-38); hind foot, 19 (18-20); ear, 13 (12-14): 14 females, total length, 144.4 (137-153); tail vertebræ, 34 (30-40); hind foot, 19 (18-20); ear, 13.5 (12.5-15). Of the remainder quite a number are so young as to fall below 110 in total length, while about one third fall between 110 and 120, and another third between 120 and 130.

These statistics bear out the statement that *orca* averages distinctly larger than true *dawsoni*.

This species was found to be very plentiful at all points where trapping was done. Their haunts are "logs and mossy banks and stumps in the spruce timber, but in a number of instances they were found digging burrows in moist earth in interspaces in the timbered region. Specimens were often found with their mouths filled with the seeds of some herb."

9. ***Microtus miurus* Osgood.** ALASKA MOUNTAIN VOLE.—One hundred and twenty-six specimens, all taken at Sheep Creek, Sept. 12-21. Only 24, or about one fifth, are adult, and of these only five are males, although the sexes are about equally represented in the series as a whole. Measurements: 5 males, total length, 154 (145-158); tail vertebræ, 26 (22-29); hind foot, 19.8 (19.5-20); ear, 13.4 (12-14): 19 females, 149.7 (140-159); 29 (24-30); 19.7 (19-20); 13.2 (12-14).

According to Mr. Anderson's notes this species was found "only about the edges of some mossy swamps in little valleys between the hills." It was taken only at the "upper sheep camp," on Sheep Creek.

10. ***Microtus operarius* (Nelson).** NELSON'S VOLE.—One hundred and seventy-three specimens, collected as follows: Muller Bay, 96, May 23-June 12; Seldovia, 48, June 27-August 19; Sheep Creek, 5, August 20-22; Barabari, 4, August 24, 28, and Sept. 1; Caribou Camp, 8, Sept. 4-8; Moose Camp, 12, Sept. 27-Oct. 8.

This was the only species of *Microtus* taken on the Alaska

Peninsula, where it was abundant, and it seems to be equally abundant on the Kenai Peninsula, where it was found at all points where collections were made. There is no appreciable difference between specimens from Muller Bay and the Kenai Peninsula. There was, as would be expected, a much higher proportion of adults in the Muller Bay series, taken in May and early June, than in the Kenai series, taken much later in the season. In the former about one half were adult, and in the latter only about one fifth. The Muller Bay adults measure as follows: 20 males, total length, 174.5 (160-192, with only two above 184); tail vertebræ, 41 (38-50, with only two above 45); hind foot, 21 (20-22); ear, 12 (11-13): 18 females, 168 (155-180); 40.7 (36-50, only two above 45); 20.6 (20-21); 12 (11-13).

At Muller Bay, says Mr. Anderson, "the runways of this animal were seen almost everywhere I went, especially in the lowlands in places where the soil was not moist. . . . During our stay at Muller Bay almost every adult female obtained was found to have from six to eight embryos." In Seldovia it was found "most abundant in some coarse grass growing beside a salt-water slough near the village. In this they had burrows and long distinct runways. Their runways were also often found in the more common grass which grows in most openings, and numbers were trapped in such places."

11. *Synaptomys dalli* Merriam. DALL'S LEMMING MOUSE.—Sixty-six specimens, taken as follows: Seldovia, 40, June 27-August 3; Sheep Creek, 12, August 14-26; Barabari, 2, August 30; Caribou Camp, 5, Sept. 7-9; Moose Camp, 7, Sept. 25-Oct. 5. About one third are adults, of which only 4 are females, 15 being males. They measure as follows: 15 males, total length, 130 (124-134); tail vertebræ, 23.7 (21-25); hind foot, 19.3 (19-21); ear, 13.7 (12-15): 4 females, 132 (129-134); 25.5 (24-27), 19 (18-20), 12.5 (13-14). The females average larger than the males, but they are also obviously older than the average of the males, the difference in size being evidently due to difference of age.

At Seldovia this species was found "most frequently in

little marshy meadows, but was also sometimes trapped in timber in places like those inhabited by red-backed mice." At Caribou Camp and at Moose Camp they were also found in similar situations.

12. *Dicrostonyx nelsoni* Merriam. NELSON'S LEMMING.—Three specimens, 2 adult and 1 young, Muller Bay, June 5, 7 and 12.

"Not at all common. Their burrows were round, clean-cut holes about an inch and a half in diameter, running directly down into the earth for some inches. In most places I saw no signs of the earth which had been removed in making the burrow."—M. P. A.

13. *Fiber spatulatus* Osgood. NORTHWEST MUSKRAT.—One specimen, Seldovia, Alaska, Oct. 13. Total length, 490; tail vertebræ, 215; hind foot, 70; ear, 20. The skull is so badly crushed that it is not available for critical comparison with allied material.

14. *Erethizon epizanthus myops* Merriam. ALASKA PORCUPINE.—One specimen, Seldovia, Aug. 1, brought in by an Indian.

"Occasionally found in the neighborhood of Seldovia."—M. P. A.

15. *Lepus americanus dalli* Merriam. DALL'S VARYING HARE.—Nine specimens, of which only 1 is fully adult, 6 are about one fourth grown, and two are about three fourths grown. The adult is from Barabari (Sept. 9) and the young are all from Sheep Creek (Aug. 11–30).

This is a very dark form of the *L. americanus* group, the prevailing color in summer pelage of the adult and the two nearly grown young being blackish, and hence very much darker than *L. americanus saliens* in corresponding pelage; but there are no very obvious cranial differences between the two forms.

*Lepus americanus dalli* was based on a skull from the Nulato River, and the external characters of the form have



not yet been made known. These specimens are referred to it provisionally, in preference to adding a new name in this very imperfectly known group.

Summer specimens of hares of the *L. americanus* group seem difficult to capture, and very few are yet extant in museums. Mr. Anderson says of the present specimens: "The first rabbits seen on the Kenai Peninsula were those taken on Sheep Creek in August. Here they had numerous runways in the tall grass of the bottomland among the alders and willows. I succeeded in shooting a number of young, but did not secure any adults until Mr. Browne caught one in a snare. Later two [young] adults were taken in a dry, grass-grown flat near our 'Barabori' camp." At Moose Camp (at timberline), although no specimens were secured, "the number of runways was sufficient to show that they were present in numbers, showing that they range both in lowland and highland."

16. ***Phoca richardsi*** (*Gray*). HARBOR SEAL.—One specimen, young, with the permanent dentition not fully developed.

17. ***Vulpes alascensis*** *Merriam*. ALASKA RED FOX.—Two specimens, skins and skulls, male and female, Muller Bay, June 2. Male, total length, 982; tail vertebrae, 445; hind foot, 190. Female, 929, 394, 165.

18. ***Vulpes kenaiensis*** *Merriam*. KENAI RED FOX.—One specimen, skin and skull, Kenai Peninsula (exact locality and date not recorded).

This species was originally described from a skull, and the external characters do not appear to have as yet been described.

Compared with *V. alascensis* the coloration is much darker throughout, the golden fulvous of *alascensis* being replaced with dark rufous, with much more and deeper black on the ears and feet, tail more fringed with black and with a larger apical area of white; lower back varied with buffy gray; chin strongly dusky; throat and fore neck superficially white, the fur basally blackish; posterior part of ventral area superficially white, like the throat, the fur dingy gray basally;

rest of lower surface dark rufous, the fur blackish basally along the median line. Ears larger, and tail shorter than in *alascensis*, but much fuller.

19. ***Ursus dalli gyas* Merriam.** ALASKA PENINSULA BEAR.—One specimen, a very old male, skin and skeleton, Muller Bay, May 29.

The ten fine specimens of large brown bears taken by Mr. Stone at Muller Bay throw much light on the question of the number of species of bears on the Alaska Peninsula. Of these specimens 9 belong to the form I recently described (this Bulletin, XVI, 1902, pp. 141-143, pll. xxx, xxxi) as *Ursus merriami* and one to *Ursus dalli gyas* Merriam, based on specimens from Pavlof Bay, on the opposite side of the peninsula from Muller Bay. The two species prove to be readily distinguishable by both cranial and external characters. With the material now in hand it is evident that the type of *U. merriami* (skull) is a middle-aged male, and that the 'topotype' (skin) is an old male *U. gyas*, this skin agreeing in coloration and character of pelage with the present old male skin of *gyas*, and not with the series of skins of *merriami*.

The collector's measurements of the *gyas* specimen are as follows: Total length, 2057; tail vertebrae, 127; hind foot, 349; height at shoulder, 1068. Approximate weight, 1600 pounds. Skull, greatest length (front of premaxillaries to end of occipital crest), 447; zygomatic breadth, 260; mastoid breadth, 250. (For further skull measurements, see table, p. 290.)

Pelage short, coarse and harsh; general coloration very dark brown; claws heavy, but little curved, rather light brown, with a strongly defined longitudinal whitish streak on the convex surface.

20. ***Ursus merriami* Allen.** MERRIAM'S BEAR.—Nine specimens, skins and skulls, Muller Bay, May 24-June 12. Of these, two are adult males and four are adult females, two of which are very old; the other three are yearlings.

The pelage is very long, soft, and woolly; color of dorsal area light yellowish brown, sides and limbs dark brown. Claws short and much curved, dark brown, the color varying somewhat in different specimens.

The collector's measurements are as follows:

No.	Sex.	Length.	Tail vertebræ.	Hind foot.	Height at shoulder.
21807	♂	1880	152	330	1067
21809	♂	1981	152	381	1092
21801	♀	1702	152	318	914
21803	♀	1880	152	305	864
21808	♀	1880	152	305	991
21810	♀	1829	152	318	1016

The long, soft, woolly coat and the light yellowish brown color of the dorsal area are in strong contrast with the short, harsh, and very dark dorsal area in *U. d. gyas*.

The type of *U. merriami*, a skull, is apparently not an average example, this skull being relatively longer and narrower than any of the six skulls here referred to that species, as shown by the detailed measurements given in the subjoined table, which, for comparison, gives the measurements of (1) an old male skull of *U. middendorffi* from Kadiak Island; (2) an old male skull of *U. dalli gyas* from Muller Bay, Alaska Peninsula; (3) the type of *U. merriami*, and of the six other skulls referred to it, all from Muller Bay; (4) an old female skull of *U. kidderi* from the hills south of Kussilluf Lake, Kenai Peninsula. Nos. 19766 (*U. middendorffi*), and 21802 (*U. dalli gyas*) are very old male skulls; Nos. 21807, 21809, and 17622 (type) are middle-aged male skulls of *U. merriami*; Nos. 21810, 21808, 21801, and 21803 are female skulls of *U. merriami*, of which 21810 is very old, with all the sutures obliterated; 21803 (unfortunately imperfect) is also old, but most of the sutures are still distinct, while the other two skulls are middle-aged.

This series of specimens shows (1) that there are two distinct types of bears on the Alaska Peninsula; (2) that *U. merriami* is much more nearly related to *U. kidderi* than to *U. dalli gyas*; (3) that neither of them are very closely related to *U. middendorffi*; (4) that the examination of a much larger amount of material is necessary before the number of species and the relationships of the big Alaska brown bears can be satisfactorily settled. I here give (Figs. 1-9) three views each of three quite distinct types of skulls, namely, the big Kadiak Bear (*U. middendorffi*), and the two species occurring

on the Alaska Peninsula, all from material obtained by Mr. Stone. As the type skull of *U. merriami* has already been figured (this Bulletin, XVI, 1902, pll. xxx and xxxi), I have selected an average skull from the series obtained in 1903, which should be carefully compared with the figures of the type skull, which is either exceptional in its narrowness and great elongation, or else the later series of specimens now referred to *U. merriami* represents still a third species, related to the *kidderi* type of bear.

The figures are all made to the same scale, and are about one fourth natural size.

21. ***Ursus middendorffi* Merriam.** KADIAK BEAR.—Eight skulls, mostly adult, Kadiak Island.

22. ***Ursus kidderi* Merriam.** KIDDER'S BEAR.—Two specimens (skins and skulls), an adult and yearling, both females, Caribou Hills, Sept. 3 and 4. Adult female, total length, 1778; tail vertebræ, 178; hind foot, 280; height at shoulder, 916; skull, greatest length, 355; zygomatic breadth, 217; mastoid breadth, 148. (For further measurements see table, p. 291.)

In age the adult female (No. 21811) is comparable with No. 21803 of *U. merriami*. The external measurements, however, are much less, except that the tail is longer; the skull measurements for the most part agree closely with some of the younger female skulls of *U. merriami*, even to the size of the teeth.

23. ***Ursus americanus* Pallas.** BLACK BEAR.—One specimen (skin and skull), adult female, Kussilluf Hills, August 19.

24. ***Putorius cicognanii alascensis* (Merriam).** JUNEAU WEASEL.—Six specimens, four males and two females, taken as follows: Sheep Creek, 2, Aug. 14 and 20; Seldovia, 4, Oct. 24. One of the Seldovia specimens is in the white winter pelage, and one is in change, the other two still retaining the summer coat, somewhat lightened, however, by the incoming [August, 1904.]

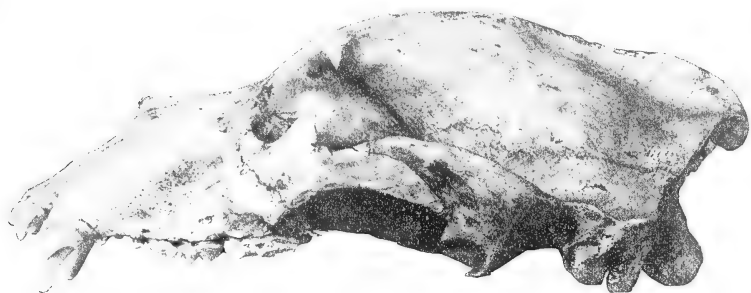


Fig. 1. *Ursus merriami*, No. 21807, middle-aged male, Muller Bay, Alaska Peninsula.  $\frac{1}{4}$  nat. size.



Fig. 2. *Ursus dalli gyas*, No. 21802, old male, Muller Bay, Alaska Peninsula.  $\frac{1}{4}$  nat. size.

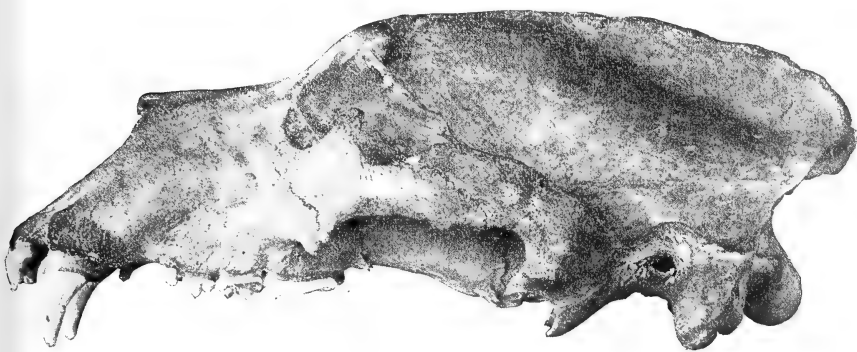


Fig. 3. *Ursus middendorffi*, No. 19766, old male, Kadiak Island, Alaska.  $\frac{1}{4}$  nat. size.

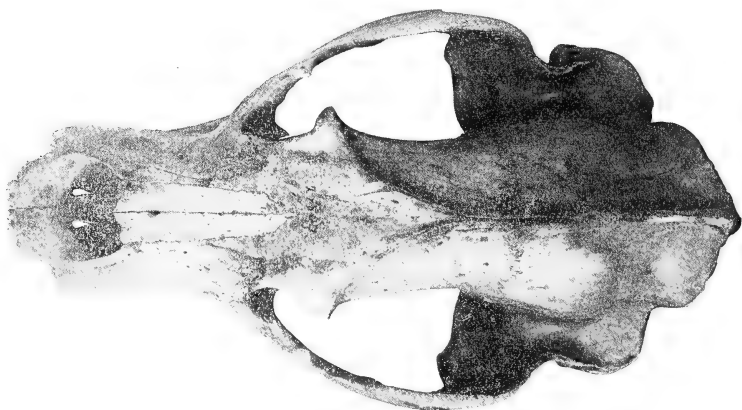


Fig. 4. Same specimen as Fig. 1.

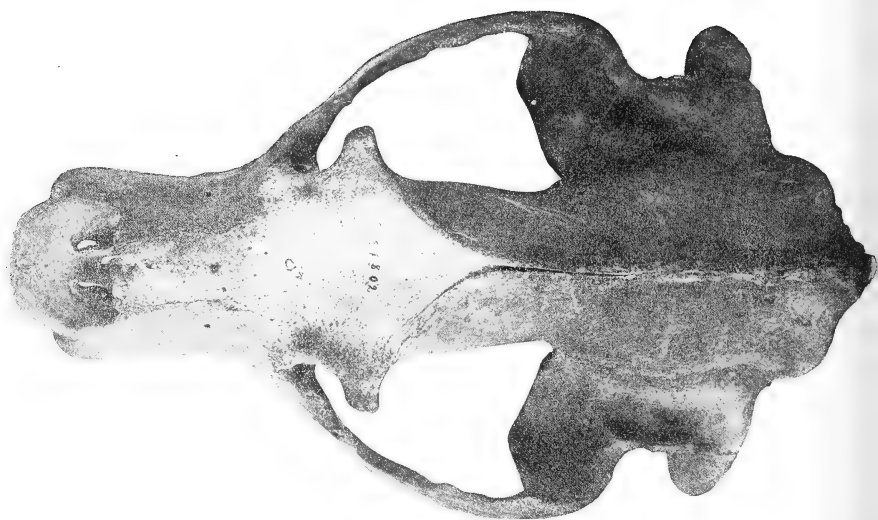


Fig. 5. Same specimen as Fig. 2.

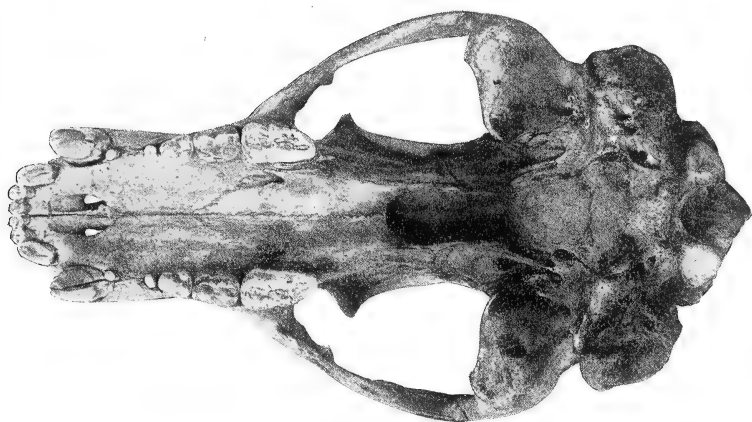


Fig. 7. Same specimen as Fig 1.



Fig. 8. Same specimen as Fig. 2.



Fig. 6. Same specimen as Fig. 3.



Fig. 9. Same specimen as Fig. 3.



## MEASUREMENTS OF TEN SKULLS OF ALASKA BROWN BEARS.

	<i>U. middendorfii</i> .	<i>U. dalli</i> Eyas.	<i>U. merriami</i> .								<i>U. kiddlei</i> .
	19766 ♂	21802 ♂	21807 ♂	21809 ♂	17622 <sup>1</sup> ♂	21810 ♀	21808 ♀	21801 ♀	21803 ♀	21811 ♀	
Greatest length (front of premax. to end of occip. crest).....	431	447	378	363	396	370	363	358	—	355	
Basal length (gnathion to post. border occip. condyles).....	400	408	353	358	375	343	340	318	—	325	
Basilar length (gnathion to basion).....	370	387	325	336	350	332	318	300	—	305	
Occipito-nasal length.....	365	385	317	337	328	314	302	303	—	308	
Occipito-sphenoid length.....	107	107	90	93	101	83	85	82	—	85	
Palatal length.....	206	211	179	184	198	185	172	172	191	173	
Postpalatal length (to basion).....	166	175	145	153	151	137	147	133	—	133	
Basion to plane of front of last upper molar..	246	263	222	226	230	211	212	202	—	202	
Zygomatic breadth.....	302	260	210	220	210	223	195	190	221	217	
Interorbital breadth.....	101	92	73	88	81	84	77	70	87	81	
Breadth across postorbital processes.....	142	141	113	119	110	128	105	104	124	110	
Mastoid breadth.....	243	250	170	182	169	172	154	159	—	148	
Breadth of rostrum at base of canines.....	101	101	87	90	85	86	77	76	88	78	
Premolar-molar series (p4-m <sup>2</sup> ).....	77	81	78	72	79	73	75	74	78.5	73	
Molar <sup>2</sup> , greatest length.....	37	39	38	35	37.5	35	37	37	37	36	
“ “ width.....	19	20	20	19.5	21	19	18	19	20	20	

<sup>1</sup> Type.

winter coat. The two August specimens, both apparently females, are very much darker.

A female from Homer, collected by the Stone Expedition in 1901, and formerly identified (this Bulletin, XVI, 1902, p. 228) as *P. arcticus kadiacensis*, is to be referred here.

The four males measure, total length, 334 (312-346); tail vertebrae, 92 (89-94); hind foot, 46 (43-49); ear, 22 (21-23). Two females, 270 (260-280), 71.5 (70-73), 35.5 (34-37), 18 (17-19).

25. ***Mustela americana* Turton.** AMERICAN MARTIN.—Two skulls, Seldovia. These skulls greatly exceed in size the very largest skulls of a large series of *M. americana* from New Brunswick, but fall considerably short of the measurements given by Mr. Osgood for the type skull of *M. a. actuosa*.

26. ***Sorex personatus* I. Geoffroy.** COMMON SHREW.—One hundred and eighty-six specimens, collected as follows: Muller Bay, 4, June 1-7; Seldovia, 97, June 26-August 2; Barabari, 9, August 6 and 28-Sept. 1; Sheep Creek, 35, August 13-26; Caribou Camp, 14, Sept. 3-9; Moose Camp, 27, Sept. 25-Oct. 6.

At Muller Bay "shrews were quite scarce," but on Kenai Peninsula this species was apparently everywhere abundant.

27. ***Sorex obscurus alascensis* Merriam.** ALASKA SHREW.—Thirty-seven specimens: Seldovia, 26, June 26-August 3; Barabari, 1, Sept. 1; Caribou Camp, 7, Sept. 3-9; Sheep Creek, 3, Sept. 12-14.

Evidently less abundant than the preceding, but widely dispersed, though apparently not met with at Moose Camp, where *S. personatus* was very abundant.

28. ***Sorex eximius* Osgood.** OSGOOD'S SHREW.—Two specimens, Barabari, Sept. 9, and Moose Camp, Oct. 1.

This species, previously known only from the type, taken at Tyonek, Cook Inlet, Alaska, Sept. 14, 1900, by Osgood and Heller, is evidently either not numerous or very hard to capture, as of 225 Shrews taken by Mr. Anderson only two were of this species.

## Article XXV.—A NEW SHEEP FROM KAMCHATKA.

By J. A. ALLEN.

The Museum has recently received from Mr. George H. Storck, a well-known fur-dealer and taxidermist of this city, two fine skulls of sheep from Kamchatka, representing two species, one being the *Ovis nivicola* and the other an apparently undescribed species. Both were obtained in that country personally by Mr. Storck, and their history is thus beyond question. The *nivicola* specimen was taken "between Milko and Petropavlovsk in southeastern Kamchatka"; the other "was taken about 110 versts east of Fort Tigil on the west side of Kamchatka." Mr. Storck adds: "I have seen several skulls up there, taken in that section, and they are all the same, that is the horns are thin at the base and have a double curve. . . . Specimens of this sheep are very hard to get, as they are found only in the central range of mountains in the northwestern portion of Kamchatka; and it is the most difficult place to travel in that I have ever faced, both on account of the roughness of the country and the almost constant storms that rage all through the winter, which is practically the only season when one can travel in the interior."

The Fort Tigil specimen is strikingly different from any previously described species, having somewhat the type of horns of *Ovis ammon*, but it is much smaller than any of the known forms of the *O. ammon* group. It may well bear the name of its discoverer and be called

### *Ovis storcki*, sp. nov.

Type, No. 22689, an old male skull, from the mountains about 75 miles east of Fort Tigil, Kamchatka; collected and presented by George H. Storck, for whom the species is named.

Horns a close spiral, forming a circle and a half, curving first outward and downward, and then, at about the end of the first circle, inward, upward, and finally outward again. The frontal surface is finely ribbed transversely to the axis of curvature, with a sharp angle at both edges, continued nearly to the tip; the exterior ('orbital') and interior ('nuchal') surfaces meet so as to form a broadly rounded



Fig. 1. *Ovis storcki*, No. 22689, old male, from near Fort Tigil, Kamchatka.  $\frac{1}{2}$  nat. size.



Fig. 2. *Ovis nivicola*, No. 22690, old male, Southern Kamchatka.  $\frac{1}{2}$  nat. size.



Fig. 3. *Ovis borealis* (?), No. 18212, old male, Taiganose Peninsula, N. E. Siberia.  
 $\frac{1}{8}$  nat. size.

'nuchal edge,' very broad basally, but becoming thinner and sharper apically. As shown by the figures (Figs. 1 and 4), the spiral is very close; at the end of the first circle the horns approach the face just in front of the orbits so nearly as to be distant from the facial portion of the skull by only a space equal to the anteorbital breadth of the skull, and then sweep abruptly outward. The form of the spiral is thus similar to that seen in *O. ammon*.

Length of horn, measured along the frontal surface, 1015 mm. (40 in.); circumference at base, 295 ( $11\frac{1}{2}$  in.); distance between tips, 605 ( $23\frac{3}{4}$  in.); distance apart at point of greatest inward curvature (opposite molars), 225 ( $8\frac{5}{8}$  in.); breadth of frontal surface at base, 80.

Skull, total length (front of premaxillæ to occipital crest), 280; basal length (premax. to posterior border of occip. condyles), 255; greatest breadth at posterior border of orbits, 168; palatal length, 125; post-palatal length (to basion), 110; palatal breadth at  $m^2$ , 47; mastoid breadth, 110; facial breadth above,  $m^2$ , 79; length of upper tooththrow, 69; last upper molar,  $20.3 \times 12.5$ .

In the length and general character of the curvature of the horns there is a close resemblance between *O. storcki* and the skull of the Siberian Argali (*Ovis ammon*) from the Altai, figured by Mr. Rowland Ward in his 'Records of Big Game' (4th ed., 1903, p. 383), but the dimensions of the horns are

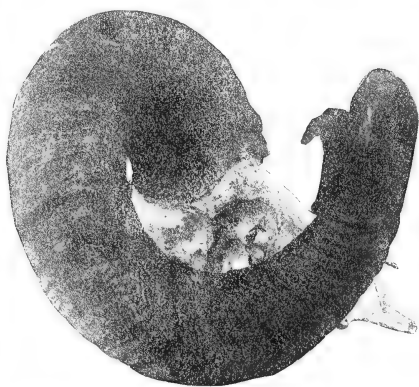


Fig. 4. Same specimen as Fig. 1.

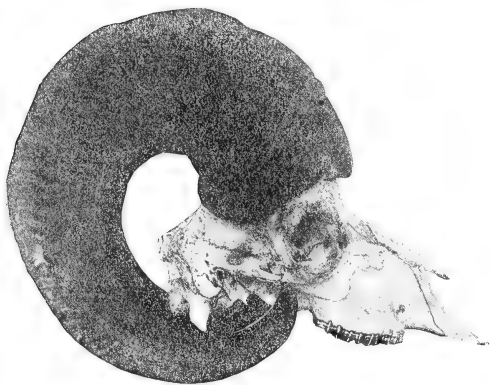


Fig. 5. Same specimen as Fig. 2.



Fig. 6. Same specimen as Fig. 3

very much less, and they differ markedly also in the character of the basal portion, to say nothing of the wide geographical separation of the two species. In regard to the difference in size, while the skull of *O. storcki* is that of a very old animal, its measurements are fully one third less than those given for old Altai skulls of *O. ammon*.

While this species differs widely from any other hitherto recognized, it may be of interest to compare the general size of the skull with the skull of *O. nivicola* collected by Mr. Storck, the species which is the nearest geographical neighbor of *O. storcki*. In linear measurements there is very little difference, aside from the horns, between the two, but *O. nivicola* has the facial portion of the skull broader, with a broader and more arched palate, and the toothrows are curved instead of straight, as in *O. storcki*. The horns of *nivicola* are of course much shorter (740 against 1015), much heavier at the base (circumference 645 against 605, width of base of frontal surface, 100 against 80), and curve continuously outward instead of recurving inward, upward, and then outward again.

As of interest in this connection figures are given of a skull of *O. nivicola* (Figs. 2 and 5), and of one of the skulls (Figs. 3 and 6) obtained by Mr. Buxton on the Taiganose Peninsula (at the head of the Okhotsk Sea), referred by me first (this Bulletin, XIX, 1903, p. 130) to *O. nivicola* and later (*ibid.*, p. 196) to *O. borealis* Severtzoff (*O. canadensis borealis* Lydekker, P. Z. S., 1902, Vol. II, p. 85), but which is probably separable from true *borealis* of the Yana River region, a thousand miles to the northwestward of the Taiganose Peninsula. However this may be, these specimens show that three very distinct species of sheep occur in close proximity within the territorial limits of Kamchatka.

In answer to my inquiries about the occurrence of *white* bighorns in Kamchatka, Mr. Storck's reply is of interest, as he has traversed the whole interior of the peninsula, from north to south, on commercial expeditions for the purchase of sable and other furs. He says: "In reference to *white* mountain sheep, I do not believe that any exist in Kamchatka. I have

never seen or heard of any, or seen any fragments of skins. If there is such a sheep it must come from north of latitude 59°. That part of the country is never hunted; it is inhabited by wandering Koraks who live entirely on the reindeer, and never kill anything except wolves, and then only to protect their herds."



## Article XXVI.—THE ANTS OF NORTH CAROLINA.

By WILLIAM MORTON WHEELER.

The following list of the ants known to occur in North Carolina has been compiled from the literature and from a fine collection made by Mr. Wm. Beutenmüller in the Black Mountain region during 1903 and 1904. Some years ago Professor A. Forel collected and studied the ants of the same region and published a series of valuable notes on their habits. The new species discovered by Forel in North Carolina are described in a paper entitled "Variétés Myrmécologiques" (Ann. Soc. Ent. Belg., Tome 45, 1901). The list shows very clearly that the ant fauna of the State in question presents a commingling of Carolinian, subboreal, and transitional species. Characteristic of the Carolinian fauna are such species as *Eciton carolinense*, *Stenamma treatæ*, *S. lamellidens*, *Solenopsis carolinensis*, *Pheidole morrisoni*, and *Ph. dentata*, *Pogonomyrmex badius*, *Leptothorax pergandei*, and *L. floridanus*, *Atta septentrionalis*, and *Dolichoderus mariae*. The following species are subboreal and peculiar to cold woods and meadows among the higher hills and mountains: *Stigmatomma pallipes*, *Myrmecina americana*, *Stenamma brevicorne*, *Myrmica brevinodis*, *Lasius neoniger*, *L. aphidicola*, *Formica difficilis*, *F. neogagates*. Most of the remaining species are transitional and widely distributed through the lowlands of the Northern States. Undoubtedly the following list, though rather extensive, is still far from complete. We should expect it to comprise several additional species belonging to the genera *Sysphincta*, *Leptothorax*, *Myrmica*, *Solenopsis*, *Strumigenys*, *Formica*, and *Camponotus*. Unless otherwise stated, the notes refer to the specimens collected by Mr. Beutenmüller.

### SUBFAMILY PONERINÆ.

1. ***Stigmatomma pallipes* Hald.** Several workers, varying in size and coloration, from the North Fork of the Swannanoa

<sup>1</sup> Ann. Soc. Ent. Belg., T. 43, 1899; Rivista di Sci. Biol., II, No. 3, Como, 1900. The latter more complete account has been translated into English by A. P. Morse (Psyche, Vol. 9, Aug.-Sept., 1901, pp. 232-238, 243-245).

River ("in siftings") and from the "Half-way Place" on Black Mountain.

2. **Proceratium melinum** *Roger*. Recorded by Roger from "Carolina."

3. **Ponera coarctata pennsylvanica** (*Buckl.*) *Emery*. A few workers and a dealated female from Black Mountain and a large number of workers from Sugar Fork, Craggy Range, Buncombe Co., and Bat Cave, Blue Ridge, Henderson Co. Among the specimens from the latter locality are two fine ergatoid females, which are nearly as large as normal females of this species and have ocelli, but the thorax constructed like that of the worker. According to Forel this species is "very common in decayed trunks and under stones."

#### SUBFAMILY DORYLINÆ.

4. **Eciton carolinense** *Emery*. Originally described from North Carolina. Cotypes received from the late Rev. P. J. Schmitt O. S. B., are labeled Belmont, Gaston Co. Forel took the species at Faisons.

5. **Eciton opacithorax** *Emery*. Taken by Rev. P. J. Schmitt O. S. B., at Belmont, Gaston Co. Eighty to one hundred specimens of an ecitophilous beetle (*Ecitonusa schmitti* *Wasmann*) were found scattered through the cluster of workers. In this nest was found the first female *Eciton* taken in the United States.

6. **Eciton schmitti** *Emery*. Many workers taken from under a large stone at Bat Cave, Blue Ridge, Henderson Co. This species has not been found hitherto east of Texas and Missouri. It occurs as far north as Colorado Springs, Colo., where I saw three colonies during the summer of 1903.

#### SUBFAMILY MYRMICINÆ.

7. **Myrmecina graminicola americana** *Emery* var. **brevispinosa** *Emery*. According to Emery there are specimens of this form from "Carolina" in the Berlin Museum.

8. **Monomorium minutum** Mayr var. **minimum** (Buckl.) Emery. This is evidently the form referred to by Forel as *M. ebeninum*, occurring at Faisons.

9. **Solenopsis texana truncorum** Forel. The worker and female types were taken by Forel at Faisons.

10. **Solenopsis texana carolinensis** Forel. The male, female, and worker types are from the same locality as the preceding. Mr. Beutenmüller took several workers on the North Fork of the Swannanoa River.

11. **Solenopsis pergandei** Forel. The male, female, and worker types were collected by Forel at Faisons.

12. **Crematogaster lineolata** (Say) Emery. Specimens from several colonies taken in the Swannanoa Valley, at Black Mountain R. R. Station and in Panther Gap, Blue Ridge, Buncombe Co. Some of the workers approach the vars. *lutescens* Emery and *subopaca* Emery, whereas others belong to the typical form as defined by Emery.

13. **Crematogaster lineolata læviuscula** Mayr. North Carolina (Emery).

14. **Pheidole pilifera** (Roger) Emery. Carolina (Emery).

15. **Pheidole vinelandica** Forel. Forel took this species at Morganton, Faisons, Goldsboro, Tyson's farm, at an altitude of more than 1000 meters. "The females and males were flying and *in coitu* in great numbers at Morganton, July 17. This form lives in the earth, under stones, along roads. It forms small mounds; its formicaries are small, but very abundant everywhere. Although the soldiers are usually distinct from the workers, intermediate forms exist, evidently much less frequent than in *Ph. kingi* and *vaslitti*, but not very exceptional." In my collection there are many specimens from Belmont. Specimens taken by Mr. Beutenmüller at Bat Cave, Blue Ridge, Henderson Co., represent a very dark variety.

16. **Pheidole tysoni** *Forel*. The types of the soldier, worker, and male were taken July 20 at Tyson's farm, at the foot of Mount Mitchell (altitude more than 1000 meters).

Mr. Beutenmüller's material comprises soldiers and workers from two colonies taken on the North Fork of the Swannanoa and at Bat Cave, Henderson Co. These specimens agree very closely with cotypes sent me by Professor Forel.

17. **Pheidole morrisi** *Forel*. All the sexual forms from North Carolina (Forel), Goldsboro, Faisons, Morganton (July 14-29). "This species makes its nest in the earth of meadows with a very conspicuous masonry dome. The colonies are very populous, and become very much excited when the dome is demolished."

18. **Pheidole morrisi vanceæ** *Forel*. All the sexual forms were taken by Forel at Black Mountain, near Mrs. Vance's villa (July 19). "It is especially this variety that makes striking earthen domes."

19. **Pheidole dentata** *Mayr*. Forel collected all the sexual forms of this species at Faisons and Goldsboro, July 26-29. "This species lives under bark of rotten trees. It does not make earthen domes."

20. **Pheidole crassicornis** *Emery*. The type (soldier only) described by Emery is from Charlotte. Forel took the workers and males at Faisons and Morganton, July 26, in rotten wood and under bark. Rev. P. J. Schmitt O. S. B. sent me specimens from Belmont.

21. **Stenamma brevicorne** *Mayr*. A single worker from the North Fork of the Swannanoa.

22. **Stenamma (Aphænogaster) tennesseense** *Mayr*. A single winged female taken during August on Black Mountain.

23. **Stenamma (Aphænogaster) treatæ** *Forel*. Workers from three colonies found on the North Fork of the Swannanoa River. According to Forel this species "abounds in the forests at Morganton, Black Mountain, near Mr. Tyson's

and here (Faisons), in all parts of North Carolina, and excavates little nests in the ground (never in logs), sometimes under stones. The workers go out singly and are fearless hunters."

24. **Stenamma (Aphænogaster) lamellidens** Mayr. North Carolina (Emery). Mr. Beutenmüller took several large workers from a colony in the Swannanoa Valley at Black Mountain R. R. Station.

25. **Stenamma (Aphænogaster) fulvum** (Roger) Emery. Workers from several colonies collected May 22-30 along the North Fork of the Swannanoa, on Gray Beard Mountain, and in Panther Gap. These specimens are all darker than the typical *fulvum*, but are furnished with long epinotal spines.

26. **Stenamma (Aphænogaster) fulvum aquia** (Buckl.) Emery. North Carolina (Emery).

27. **Stenamma (Aphænogaster) fulvum aquia** (Buckl.) Emery var. *rude* Emery. North Carolina (Emery).

28. **Stenamma (Aphænogaster) fulvum aquia** (Buckl.) Emery var. *piceum* Emery. Workers from Blue Ridge, near Black Mountain R. R. Station.

29. **Pogonomyrmex badius** Latreille. Forel found two formicaries of this species at Faisons. This must be very near the northernmost limit of its range.

30. **Myrmica rubra brevinodis** Emery. Two workers. Half-way Place, summit of Black Mountain and North Fork of the Swannanoa River. These localities must be near the southernmost limit of the range of the genus *Myrmica* in the Atlantic States.

31. **Leptothorax (Dichothorax) pergandei** Emery. Morganton, N. C. A specimen sent me by Professor Forel.

32. **Leptothorax (Dichothorax) floridanus** Emery. Faisons, N. C. A specimen received from Professor Forel.

33. *Strumigenys clypeata* Roger. "Carolina." (Roger.)

34. *Atta* (*Trachymyrmex*) *septentrionalis* McCook [= *tardigrada* (Buckl.) auct.]. Black Mountain. (Forel.)

SUBFAMILY DOLICHODERINÆ.

35. *Dolichoderus plagiatus* Mayr var. *beutenmülleri* var. nov. Differs from the typical form in the total absence of spots on the basal gastric segments. Eleven workers taken by beating, near the Black Mountain R.R. Station.

36. *Dolichoderus mariæ* Forel. A large colony, comprising several hundred workers of this beautiful species, found under a small stone in the pine woods at Panther Gap, Blue Ridge, Buncombe Co.

37. *Dolichoderus taschenbergi* Mayr. Emery mentions specimens from "Carolina" in the Berlin Museum.

38. *Dorymyrmex pyramicus* Roger var. *niger* Pergande. Façons, N. C. (Forel.)

39. *Dorymyrmex pyramicus* Roger var. *flavus* McCook. Façons, N. C. (Forel.) Forel describes a mixed colony of this and the preceding variety.

40. *Tapinoma sessile* (Say) Emery. Workers from four colonies of the typical dark-colored form of this species. Different localities in the Swannanoa Valley, Black Mountain, etc.

41. *Iridomyrmex analis* André. This is, in all probability, the form mentioned by Forel as occurring near Morganton, N. C., and as being related to *I. humilis*.

SUBFAMILY CAMPONOTINÆ.

42. *Brachymyrmex heeri depilis* Emery. Several workers from the North Fork of the Swannanoa River.

43. *Prenolepis imparis* (Say) Emery var. *testacea* Emery. Numerous workers from six different colonies of this variety,

which is paler and smaller than the typical form. Swannanoa Valley.

44. **Prenolepis parvula** Mayr. Several workers from Black Mt. R. R. Station.

45. **Lasius niger** L. var. **americanus** Emery. Numerous workers from four colonies, North Fork of the Swannanoa River; Black Mt. R.R. Station; Sugar Fork, Craggy Range.

46. **Lasius niger** L. var. **neoniger** Emery. Workers of a light-colored form of this variety from two colonies taken on the North Fork of the Swannanoa River and at Blue Ridge, Henderson Co.

47. **Lasius brevicornis** Emery. Numerous workers from Blue Ridge, near Black Mt. R. R. Station.

48. **Lasius umbratus mixtus** Nyl. var. **aphidicola** (Walsh) Emery. Workers from four colonies taken in the Swannanoa Valley at Black Mountain and Panther Gap, Blue Ridge.

49. **Lasius (Acanthomyops) claviger** Roger. A dozen workers taken at Panther Gap, Blue Ridge.

50. **Lasius (Acanthomyops) murphyi** Forel. The male, female, and worker were described by Forel from specimens taken at Morganton, July 16.

51. **Formica sanguinea rubicunda** Emery. Workers from two colonies, with *F. subsericea* as slaves. Panther Gap, Blue Ridge.

52. **Formica rufa integra** Nyl. Forel mentions the occurrence of a considerable colony of about thirty nests of this species near Faisons.

53. **Formica difficilis** Emery. Workers and females were taken by Forel near Mr. Tyson's farm (north Fork of the Swannanoa River). Many workers from three colonies collected by Mr. Beutenmüller at Black Mt. R. R. Station, and

at Panther Gap, Blue Ridge. Among the specimens from the former locality is a dealated female of the remarkably small size and pale coloration so characteristic of this sex in *F. difficilis*, which should rank as a distinct species (and not as a subspecies of *F. rufa*) related to *F. microgyna* Wheeler.

54. ***Formica exsectoides* Forel.** Mentioned by Forel as occurring near Black Mountain.

55. ***Formica pallide-fulva schaufussi* Mayr.** Many workers of the typical form from Black Mt. R. R. Station and Panther Gap, Blue Ridge. Among those from the latter locality is a specimen of the myrmecophilous beetle, *Cremastocheilus harrisii* Kirby.

56. ***Formica pallide-fulva nitidiventris* Emery var. *fuscata* Emery.** Numerous workers from two colonies taken at Black Mountain.

57. ***Formica fusca* L. var. *subsericea* (Say) Emery.** Workers from two colonies collected near Black Mt. R. R. Station. Among one lot of these workers were two specimens of the myrmecophilous beetle, *Cremastocheilus canaliculatus* Kirby.

58. ***Formica fusca subpolita* Mayr var. *neogagates* Emery.** Workers from two colonies collected on Gray Beard Mountain, Blue Ridge.

59. ***Polyergus rufescens lucidus* Mayr.** In my collection there is a single worker of this subspecies from Belmont (Rev. P. J. Schmitt O. S. B.).

60. ***Camponotus castaneus americanus* Mayr.** Workers, soldiers, and a male from four formicaries found on Gray Beard Mountain, and at Panther Gap, Blue Ridge.

61. ***Camponotus herculeanus pennsylvanicus* De Geer.** Numerous workers, soldiers, males, and females taken in various localities about Black Mountain.



Article XXVII.—NEW MIOCENE RHINOCEROSES WITH  
REVISION OF KNOWN SPECIES.

RHINOCEROS CONTRIBUTIONS, No. 6.

By HENRY FAIRFIELD OSBORN.

The recent American Museum of Natural History expeditions under Dr. W. D. Matthew and Mr. J. W. Gidley have greatly extended our knowledge of Miocene stratigraphy, enabling us to distinguish Lower, Middle, and Upper horizons, with their characteristic faunæ, more or less clearly.

In 1898 a special expedition for rhinoceroses was conducted in the Republican River Valley of western Kansas, where Cope's principal Miocene types were obtained, in the hope of extending our knowledge especially of *Peraceras superciliosus* and *Aphelops malacorhinus*. This object was not attained. Our subsequent expeditions, however, to Colorado and Montana, chiefly under Dr. Matthew's direction, yielded specimens of the former species and of a number of new forms from the Middle and Upper Miocene. I am especially indebted to Dr. Matthew for several valuable observations on this collection.

My division of the rhinoceroses of Europe<sup>1</sup> and America

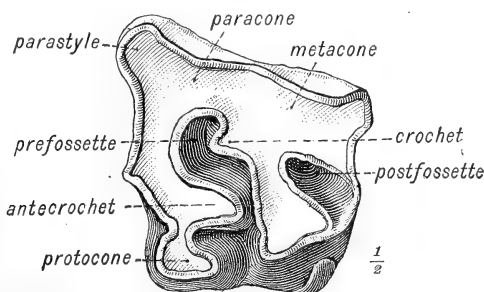


Fig. 1. Molar of *Teleoceras fossiger* with terminology.

into a number of contemporaneous and quite distinct phyletic series, characterized by profound differences in the proportions

<sup>1</sup> Osborn, H. F. Phylogeny of the Rhinoceroses of Europe. Bull. Amer. Mus. Nat. Hist., XIII, 1900, pp. 229-267.

of the skull and limbs and in the position and development of the horns, has rendered it altogether probable that we have much yet to learn regarding the polyphyletic relations of American Miocene rhinoceroses.

The object of the present paper is briefly to revise the species already described, in the chronological order of their original description, and to add a number of apparently new forms. The chief bases of specific and generic distinction have been already clearly stated in previous articles by the writer.

# I. SYSTEMATIC REVISION OF SPECIES.

## 1. *Rhinoceros crassus* Leidy.

Proc. Acad. Nat. Sci. Phila., 1858, p. 28. Extinct Mammalian Fauna of Dakota and Nebr., 1869, p. 228, pl. xxiii, figs. 4-9.

Type (Leidy): "Small fragments of two lower jaws, of young animals, a much worn upper incisor, a last upper molar, and an upper premolar apparently of the deciduous series." From the valley of the Niobrara River.

The third superior molar (*l. c.*, figs. 4-9, right side), distinguished by a feeble anticrochet and moderately developed crochet. The association of all these specimens, namely, the molar, an incisor (*l. c.*, fig. 6), a milk molar; (*l. c.*, fig. 5), is doubtful.

This type and species are indeterminate owing to the uncertainty as to the type.

## 2. *Rhinoceros meridianus* Leidy.

Proc. Acad. Nat. Sci. Phila., 1865, pp. 176, 177. Extinct Mammalian Fauna of Dakota and Nebr., 1869, p. 229, pl. xxiii, fig. 10.

Type: a fractured first or second superior molar of the right side; moderately strong crochet, and well-developed anticrochet; no crista. Locality, "Texas."

This species is indeterminate.

## 3. *Rhinoceros hesperius* Leidy.

Proc. Acad. Nat. Sci. Phila., 1865, p. 177. Extinct Mammalian Fauna of Dakota and Nebr., 1869, p. 230, pl. xxiii, figs. 11, 12.

Type: right ramus of lower jaw from the supposed Miocene

of Calaveras County, California. The museum location of this type specimen has not been ascertained. The geological horizon is uncertain; it may be of Oligocene age.

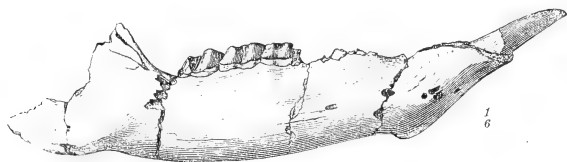


Fig. 2. Type of *Rhinoceros hesperius*. After Leidy.  $\times \frac{1}{6}$ .

#### 4. *Rhinoceros matutinus* Marsh.

Proc. Acad. Nat. Sci. Phila., 1870, pp. 2, 3.

Type: a last lower molar (Yale Mus.); from the Miocene of Squankum, N. J. No figure or adequate description has been published.

This species is indeterminate at present.

#### 5. *Aceratherium megalodum* Cope.

Palæont. Bull. No. 14, 1873, pp. 1, 2. Bull. U. S. Geol. Surv. of Terr., 1873, p. 520.

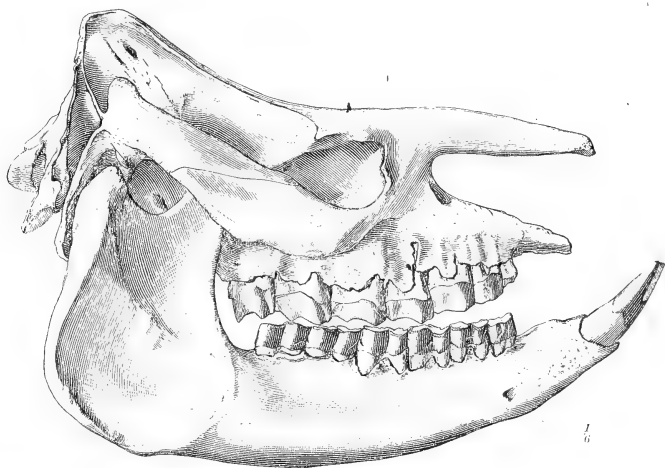


Fig. 3. Type of *Aceratherium* (= *Aphelops*) *megalodum* Cope.  $\times \frac{1}{6}$ .

Type: a complete skull and lower jaws, Middle Miocene, Pawnee Buttes, northeastern Colorado. Amer. Mus., Cope. Coll., No. 8292 (Fig. 3).

This male skull, which was subsequently made the type of the genus *Aphelops* by Cope, is mesaticcephalic. Nasals smooth, flattened, and elongate. Occiput moderately high, narrow superiorly, and inclining forward. Lower canines large.  $P^1$  present,  $p_2^2$  large. Grinding series comparatively simple, brachyodont, with moderately developed anticrochets and crochets, and well defined posterior fossettes.

= *Aphelops megalodus* Cope.

This animal is apparently a collateral or direct ancestor of *Peraceras superciliosus*, see p. 324.

#### 6. *Aphelops jemezianus* Cope.

Proc. Acad. Nat. Sci. Phila., 1875, pp. 258-261. Palæont. Bull. No. 19, "June 28, 1875," p. 4. Wheeler's Survey, Palæontology, Part ii, 1877, p. 319, plates 73, 74.

Type: a lower jaw with  $m_{1-3}$  and back part complete. Coll. Nat. Mus. Locality near the town of Santa Clara on the west side of the Rio Grande, of Upper Miocene, Loup Fork Age.

This species is indeterminate owing to the inferior character of the type.

#### 7. *Aphelops fossiger* Cope.

Bull. U. S. Geol. & Geogr. Surv. of Terr., 1878, IV, p. 382.

Type: skull, No. 8390, Amer. Mus., Cope Coll. (Fig. 4). from the Upper Miocene, Loup Fork, of northern Kansas.

A well known and decidedly progressive species, with broad occiput, laterally compressed nasals, and a terminal horn; hence made the type of the genus *Teleoceras* by Hatcher.

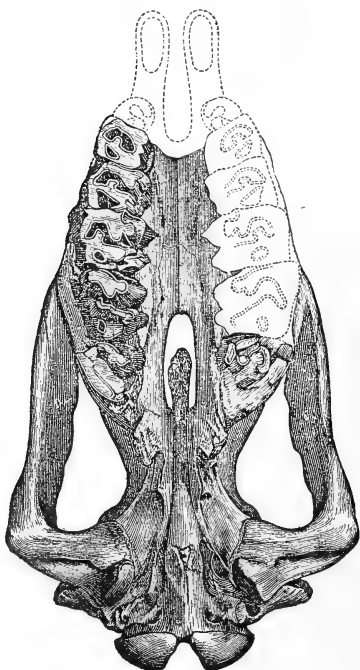


Fig. 4. Type of *Aphelops* (= *Teleoceras*) *fossiger* Cope.  $\times \frac{1}{2}$ . After Cope.

Large upper and lower cutting teeth; anterior premolars reduced, crowns of  $p^2$ ,  $p^3$  with crochet and anticrochet; molars enlarged, decidedly hypsodont, with strongly constricted protocone, strong anticrochet, and posterior fossette. Limbs extremely short.

= *Teleoceras fossiger*.

#### 8. *Aphelops malacorhinus* Cope.

Amer. Nat., XII, p. 488.

Type: skull with crushed occiput, No. 8381, Amer. Mus., Cope Coll. (Fig. 5). Cotype: an elevated occiput (Amer. Mus., No. 8439) narrowing superiorly, not of certain association with this species, Fig. 20, from Sappa Creek, Decatur Co., Kansas. Smooth, abbreviated, and transversely flattened nasals.

$P1-\frac{4}{3}$ ; grinding teeth differing from those of *T. fossiger* in greater relative size of the premolar series, in somewhat shorter crowns of the true molars; protocone not constricted; small anticrochets. Very strong crochets present on premolars and molars, unlike *P. superciliosus*.

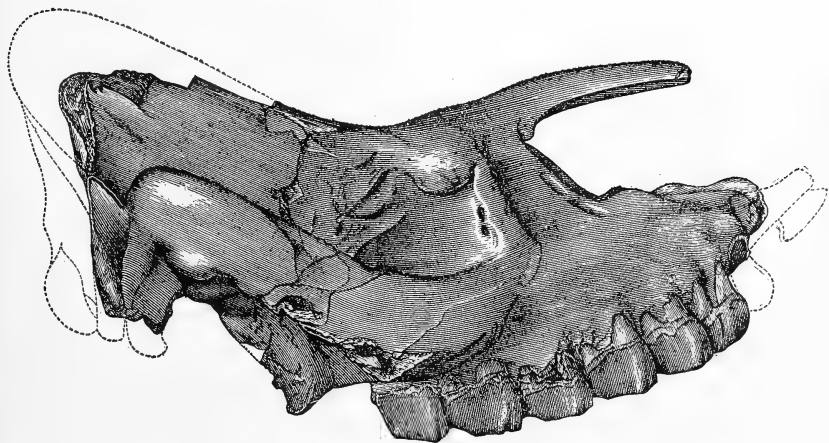


Fig. 5. Type of *Aphelops malacorhinus* Cope. After Cope.  $\times \frac{1}{8}$ .

This type shows affinities to *Aphelops megalodus* and *Peraceras superciliosus*. Professor Cope's association of very long limbs and foot bones with this species still awaits confirmation.

9. *Peraceras superciliosus* Cope.

Amer. Nat., XIV, 1880, p. 540.

Type: from the superior Miocene or Loup Fork of the Republican River valley, Nebraska, a cranium lacking extremities of the nasals; No. 8380, Amer. Mus., Cope Coll.

The skull (Fig. 6) exhibits the extreme of brachycephaly; occiput broad, low, and inclined forward; zygomata extremely widely arched, and skull foreshortened anteroposteriorly. Pattern of the grinding teeth comparatively simple; no

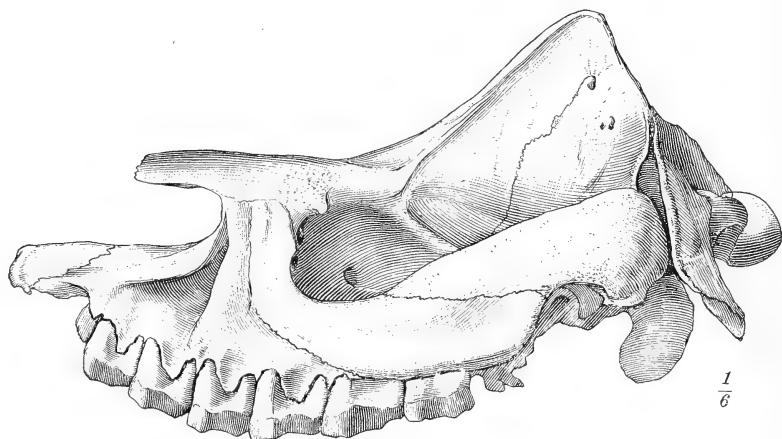


Fig 6. Type of *Aphelops* (*Peraceras*) *superciliosus* Cope.  $\times \frac{1}{6}$ .

crochets on the premolars as in *A. malacorhinus* and *A. megadolus*. Anticrochets on the molars, but crochets not strongly developed. Nasals flattened, probably hornless.

A skull (Amer. Mus., No. 10872) belonging to this rare species was found in the summer of 1903 in typical Loup Fork deposits of the Little White River. Of somewhat younger age, the teeth are less worn than in the type and show: (1) less extreme hypsodonty than in *T. fossiger*; (2)  $p^1$  small but well preserved, usually absent in *T. fossiger*; (3)  $p^2$  relatively much larger than in *T. fossiger*.

Jaws (Amer. Mus., No. 10878) found in the same region as the above skull possibly belong to this species; as compared

with those of *T. fossiger* they exhibit (1) large canines, (2) a wide space between  $m_3$  and the coronoid process, (3) forward pitch or inclination of the condyle and coronoid region, (4) somewhat less hypsodont molars. Portions of an associated skeleton exhibit a scapula, short but somewhat different in form from that of *A. fossiger*, also an atlas with relatively pointed transverse processes.

#### 10. *Rhinoceros proterus* Leidy.

Proc. Acad. Nat. Sci. Phila., 1885, p. 33. *Aphelops fossiger* Leidy, fide Lucas, Trans. Wagner Free Inst., IV, 1896, p. 41.

Type: a last upper molar from Peace Creek, Florida. Coll. Nat. Mus.

Careful study of this type and associated material led F. A. Lucas to the conclusion that *R. proterus* may be considered at most as a sub-species of *Teleoceras fossiger*, distinguished by slightly smaller molars, with thinner crests, better development of the cingulum on  $p^3$  and  $p^4$ , the bones of the foot averaging a little heavier and more rugose.

= *Teleoceras fossiger* Cope, var.  
*T. proterus*.

#### 11. *Eusyodon maximus* Leidy.

Proc. Acad. Nat. Sci. Phila., 1886, p. 37, figs. 1, 2.

Type: a lower tusk found in Archer, Florida.

This species (Fig. 7) appears to have been based upon a lower tusk of *R. proterus*, which is a synonym of *T. fossiger*, Cope.

— *Teleoceras fossiger* Cope.

#### 12. *Aceratherium acutum* Marsh, 1887.

Amer. Journ. Sci. (3), XXXIV, p. 325, figs. 3, 4.

Type: complete skull and lower jaws from the Upper

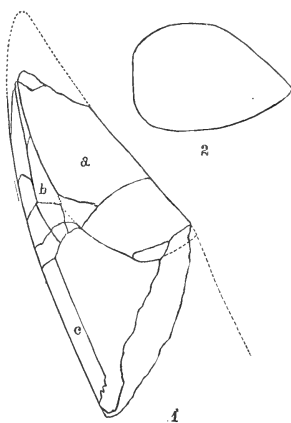


Fig. 7. Type of *Eusyodon maximus* Leidy.  $\times \frac{1}{2}$ . After Leidy. 1. Side view. 2. Cross section.

Miocene, Loup Fork, of Long Island, Phillips County, Kansas (Figs. 8, 9). Yale Museum.

This locality is rich in crania of *Teleoceras fossiger*, and this type represents a skull of that species.

= *Teleoceras fossiger* Cope.

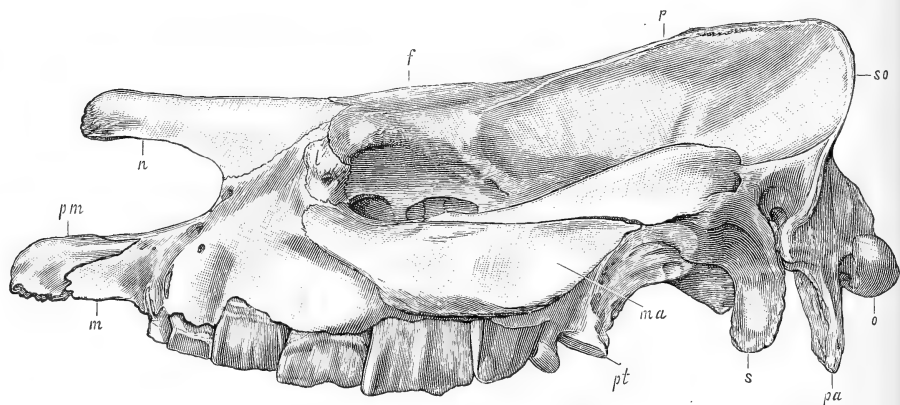


Fig. 8. Type of *Aceratherium acutum* Marsh (= *T. fossiger*).  $\times \frac{1}{3}$ . After Marsh.

### 13. *Rhinoceros longipes* Leidy.

Proc. Acad. Nat. Sci. Phila., 1890, p. 183. = *Aphelops malacorhinus* Cope, *fide* Lucas, Trans. Wagner Free Inst., IV, Jan., 1896, p. 45.

Type: a lower canine and second and fourth metacarpal. Coll. Nat. Mus.

This species was identified by F. A. Lucas (*op. cit.*, p. 45) with *Aphelops malacorhinus* Cope, distinguished by the elongation of the limb and foot bones, but it now appears possible that *A. malacorhinus* was not a long-limbed type. If so, *R. longipes* may prove to be a valid species.

### 14. *Teleoceras major* Hatcher.

Amer. Geol., XIII, March, 1894, p. 148. Amer. Nat., XXVIII, 1894, p. 241, pl. ii, figs. 2, 6.

Type: greater portion of the skull and lower jaw, Princ. Mus., from the Loup Fork beds of Sheridan County, Nebraska, Upper Miocene.

A sagittal crest and a median horn situated on the extreme



point of the nasals, directed forward and upward, and extending considerably beyond the extremities of the nasals proper. This definition establishes the genus *Teleoceras*.

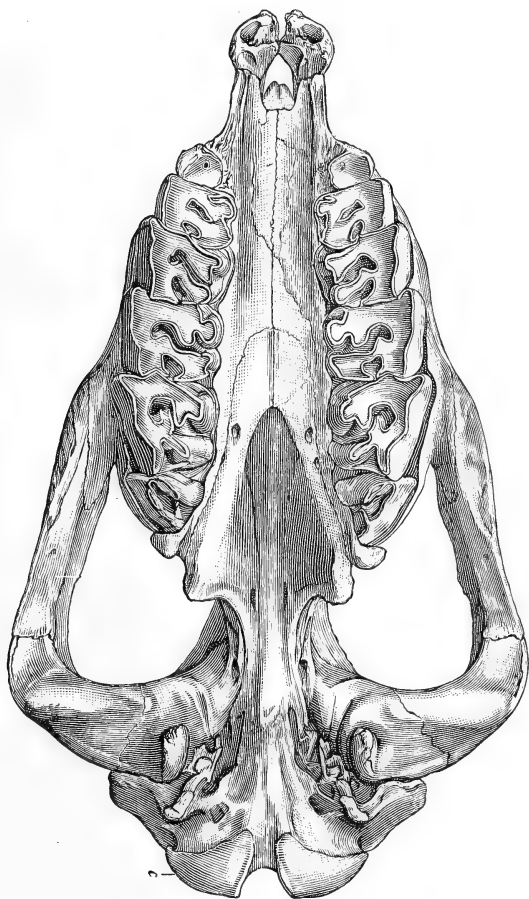


Fig 9. Type of *Aceratherium acutum* Marsh (= *T. fossiger*).  
 $\times \frac{1}{8}$ . After Marsh.

This species may be distinguishable by its large size from Cope's type of *T. fossiger*. Unworn molars would show a crochet.

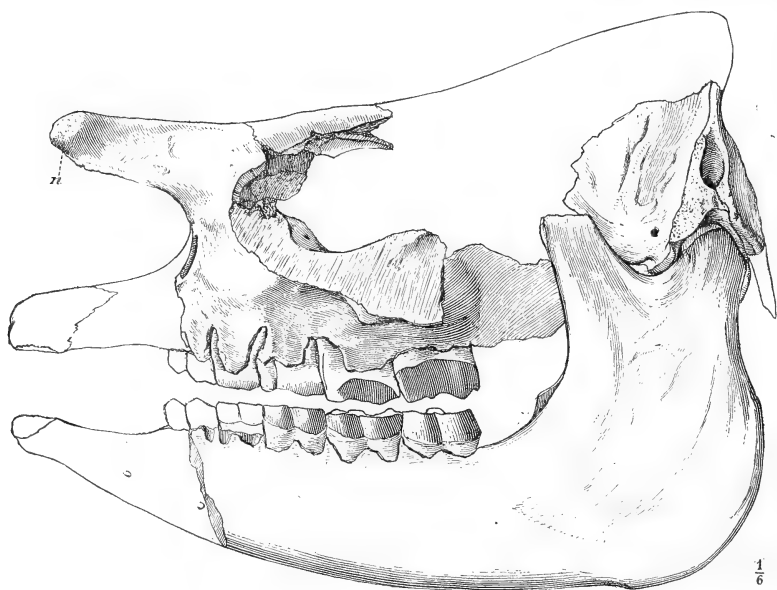


Fig. 10. Type of *Teleoceras major* Hatcher.  $\times \frac{1}{6}$ .

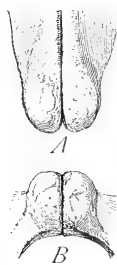


Fig. 11. Type nasals of *Teleoceras major* Hatcher. Superior and anterior views.



Fig. 12. Type nasals of *Aphelops ceratorhinus* Douglass.  $\times \frac{1}{3}$ . After Douglass.

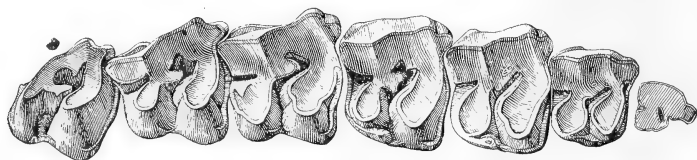


Fig. 13. Type molars of *A. ceratorhinus*.  $\times \frac{1}{3}$ . After Douglass.

15. *Aphelops ceratorhinus* Douglass.

New Vertebrates from the Montana Territory. Ann. Carnegie Mus., II, No. 2, 1903, pp. 145-200.

Type: part of skull, mandible, and limb bones, Carn. Mus., No. 857, from the Lower Madison Valley, Montana, Upper Miocene (Figs. 12-14).

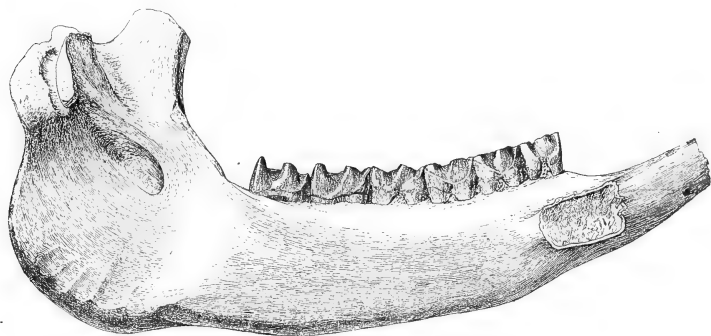


Fig. 14. Type lower jaw of *A. ceratorhinus*, inner view.  $\times \frac{1}{2}$ . After Douglass.

Size, large. Nasals elongate, flattened, with terminal horn rugosities. Mandible long and slender. Grinding series brachyodont. Full superior premolar-molar series; premolars with internal cingula;  $p^4-m^3$  with crochets;  $m^{1-3}$  with reduced anticrochets; upper premolar-molar series = .268; lower premolar-molar series = .250.

A jaw and considerable part of the skeleton (Amer. Mus., No. 9745), found near the same locality in Montana, enable us to give some skeletal characters as follows: limb bones, metacarpals, and metatarsals elongate, hence to be compared with *R. longipes* Leidy.

16. *Aceratherium profectum* Matthew.

A provisional classification of the Freshwater Tertiary of the West. Bull. Amer. Mus. Nat. Hist., XII, Art. iii, Apr. 8, 1899, p. 71, footnote.

Type: A lower jaw, fragments of upper teeth, right squamosal region of skull, and atlas (Amer. Mus. No. 9082, Fig. 15).

This is an animal of small size, distinguished specifically by

the dentition:  $\overline{2} \ \overline{0} \ \overline{4} \ \overline{3}$ . Very narrow diastema.  $P_1-m_3$  192 mm. Grinding teeth brachyodont. An anticrochet in superior molars. Postglenoid flaring widely, not in actual contact with posttympanic. Posterior portion of zygoma deep.

The generic reference is provisional at present.

= *Aphelops profectus*.

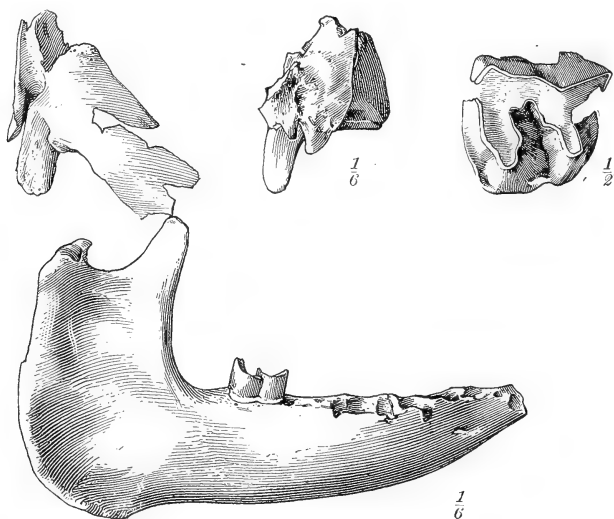


Fig. 15. Type of *Aceratherium profectum* Matthew (= *Aphelops ? profectum*). Lower jaw ( $\times \frac{1}{6}$ ); right squamosal region, side and rear views ( $\times \frac{1}{6}$ ) and  $m^2$  ( $\times \frac{1}{2}$ ).

## 2. DESCRIPTIONS OF NEW SPECIES.

### *Middle Miocene.*

#### 17. *Cænopus persistens*, sp. nov.

Type: Cranium and left superior grinding series, Amer. Mus., No. 9081, from the Middle Miocene of northeastern Colorado.

This is a surprisingly primitive animal Fig. 16, of small size, somewhat dolichocephalic, with sagittal crest, high, backwardly directed occiput, narrow posttympanic processes not connected with postglenoid processes, and therefore leaving auditory meatus open inferiorly, slender zygomatic arch, wide

space between orbits and narial notch, slender, laterally decurved nasals (of which the tip is wanting), molars brachydont, with large anticrochet and no crochet.

The grinders preserved ( $p^2-m^2$ ) measure only 172 mm.

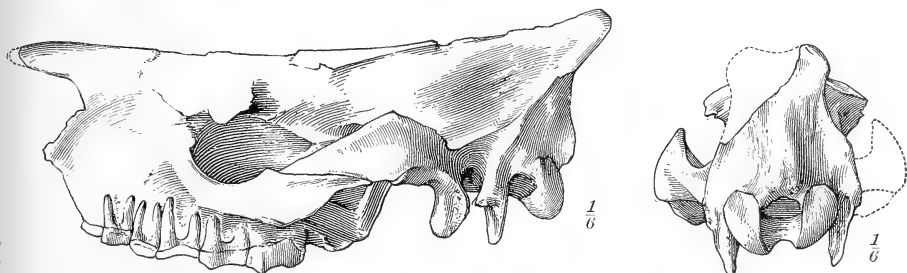


Fig. 16. Type of *Canopus persistens*, sp. nov.  $\times \frac{1}{6}$ .

#### 18. *Teleceras medicornutus*, sp. nov.

Type: skull lacking occiput, with jaws lacking angle, Amer. Mus., No. 9832. Collected by Albert Thomson in the Middle Miocene of eastern Colorado, about twenty-five miles north of Pawnee Buttes. The sex is somewhat doubtful because although the nasal horns are large, the lower canines are small. Cotype: skull and jaws, Amer. Mus., No. 9374, with complete occipital and parietal crests.

The name *medicornutus* refers to the presence of a small median horn rugosity on the frontals which reminds us of a similar rugose area doubtfully determined in the lower Miocene *T. aurelianensis* of France by Professor Gaudry.

The *Teleoceras* characters of this species are the laterally compressed nasals, terminal horn, median rugosity on the basioccipitals, premolars relatively reduced (108 mm.), molars hypsodont and expanded (153), protocone constricted. It is in some respects more primitive and is otherwise clearly distinguished from the Upper Miocene *T. fossiger* by: (1) much longer (138) free nasals, (2) longer space (95) between the narial notch and orbits, indicating less brachycephaly, (3) less prominent crochet on the molars, (4) much smaller lower canines, (5) premolars  $\frac{1}{2}$ . The jaw exhibits definitely only two premolars in the type; in the cotype a one-rooted  $p_2$  is present. The lower series ( $p_3-m_3$ ) measures 238mm. The

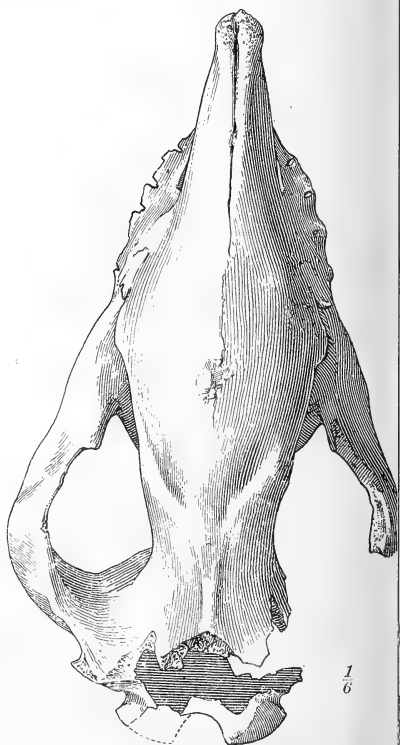
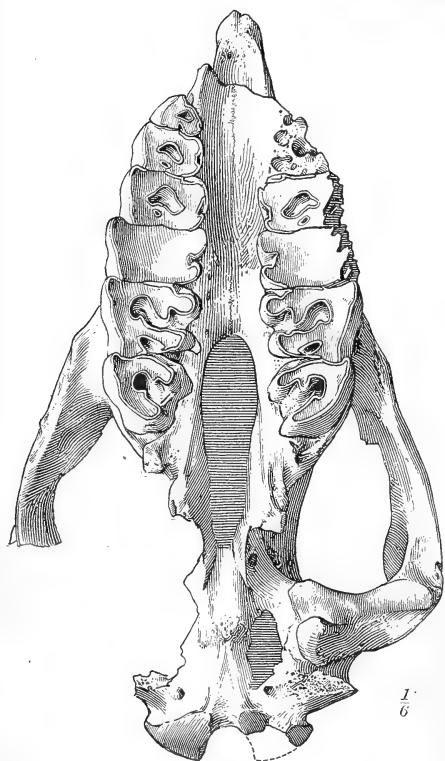
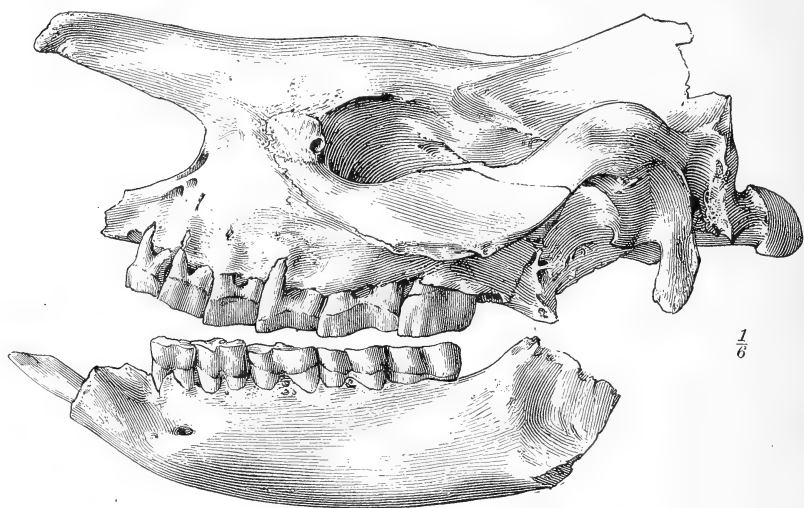


Fig. 17. Type of *Teleoceras medicornutus*, sp. nov. The larger figures  $\times \frac{1}{6}$ , the smaller (detail of horn rugosity)  $\times \frac{1}{2}$ .

canine tusks are small, although the animal is probably a male. The cotype shows a low but well defined sagittal crest and an occiput relatively higher and narrower than that of *T. fossiger*; the deep zygomatic arch is well shown.

19. *Aphelops* (? *Peraceras*) *planiceps*, sp. nov.

Type: posterior portion of a cranium, Amer. Mus., No. 9369, from the Middle Miocene, Pawnee Buttes, of Colorado.

This broadly depressed and brachycephalic skull differs widely in base and top structure from that of other species as follows: (1) basioccipital flattened, with a sharp, low median keel; it lacks the convex median rugosity (for the



Fig. 18. Type of *Aphelops* (? *Peraceras*) *planiceps*, sp. nov.  $\times \frac{1}{6}$ .

rectus capitis muscles) of *T. medicornutus* and *T. fossiger*, or the paired rugosities of *A. megalodus* and *P. superciliosus*, (2) top of cranium depressed, with sagittal crest separated into two supratemporal ridges, (3) glenoid facets very broad

internally, (4) occiput very low, broad, with widely flaring postglenoid processes.

A skeleton (Amer. Mus., No. 9369) found near this skull, but not of certain association, indicates limbs somewhat longer than those of *T. fossiger*.

The affinities of this cranium are problematical; the resemblances are rather with *Peraceras superciliosus* than with *Teleoceras*.

*Upper Miocene.*

20. *Aphelops* (? *Diceratherium*) *brachyodus*, sp. nov.

Type: Base of cranium, palate, and full set of superior molars, Amer. Mus., No. 10873, from the Loup Fork Upper Miocene of the Little White River, South Dakota.

This slender, primitive, dolichocephalic, and brachyodont (hence the name *brachyodus*) type is our most surprising discovery in the Upper Miocene; nothing similar has been found before. In the absence of the front part of the skull and teeth its affinities cannot be determined; although a smaller form it may prove to be related to the Upper Miocene *Aphelops ceratorhinus* of Douglass, or to the Oligocene *Diceratherium*.

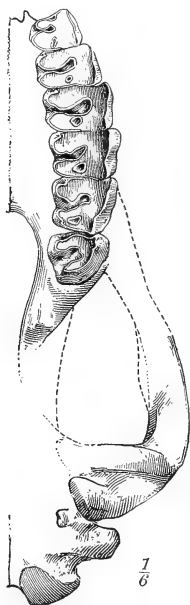
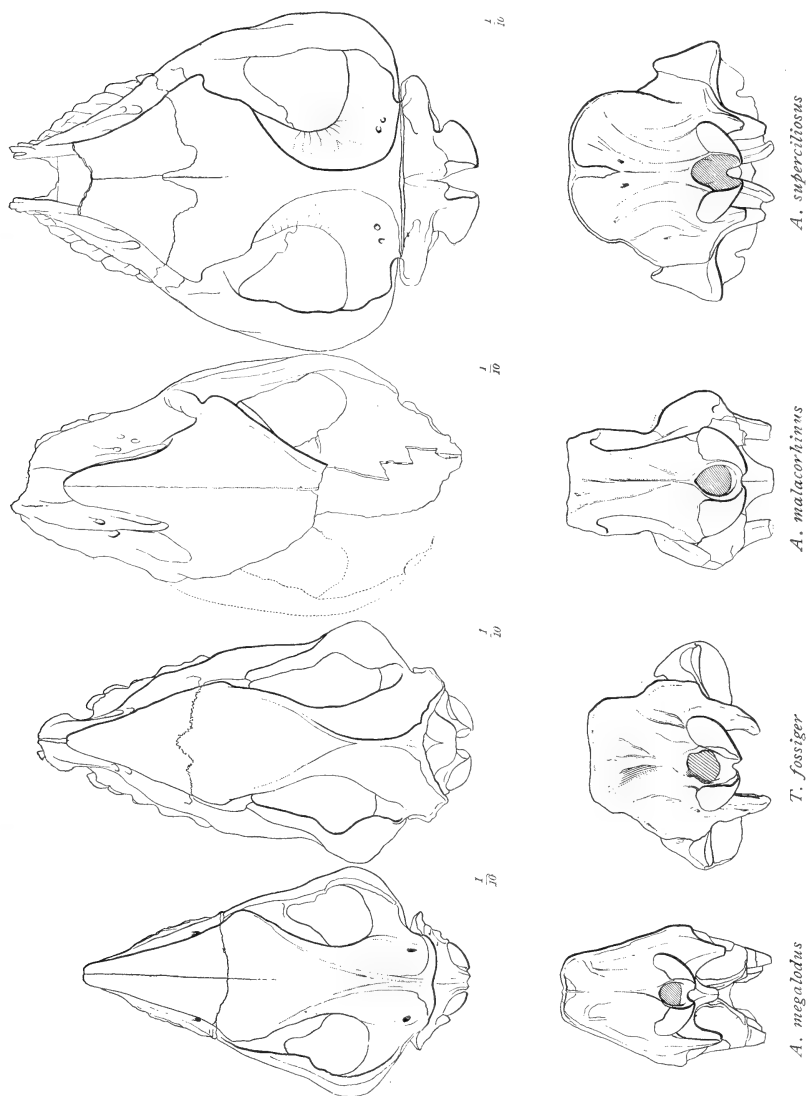


Fig. 19. Type of *Aphelops* (? *Diceratherium*) *brachyodus*, sp. nov.  $\times \frac{1}{6}$ .

(1) The grinders are all extremely short, and although well worn entirely lack the crochet; the anticrochet is moderately developed and a crista appears on  $m^3$ . (2) The series,  $p^2-m^3$ , measures 215 mm.; the premolars ( $p^2-p^4$ ) occupy a relatively large space (95) as compared with the space (122) occupied by the molars ( $m^1-m^3$ ). (3) Considering the diminutive teeth the skull is elongate, the distance from the occipital condyles to  $p^2$  being 465 as compared with 555 in a large skull of *T. fossiger*; the space between the postglenoid and occipital condyles is very wide. (4) There is a low sagittal crest.



Fig. 20. Comparative series,  $\times 10$ .

## 3. CONCLUSIONS AS TO PHYLOGENY.

It is obvious from the foregoing studies that we have at least three and possibly four contemporary phyla of Miocene rhinoceroses, as follows:

1. The first and most fully known phylum is the Brachypodinae, already defined by the writer, characterized by extremely short limbs and feet, skull mesaticephalic to brachycephalic, nasals laterally compressed, with a terminal horn, narrow supraorbital region, strongly hypsodont, premolars reduced. Middle Miocene, *Teleoceras medicornutus*; Upper Miocene, *Teleoceras fossiger*, *T. major*.

2. The second phylum cannot fully be defined at present. It is characterized by moderately short limbs, skull brachycephalic, broadly flattened nasals without terminal horn, broad supraorbital region and crests, moderately hypsodont grinders, upper premolars less reduced. Middle Miocene, *Aphelops megalodus*, *A. (Peraceras?) planiceps*; Upper Miocene, *A. (Peraceras) superciliosus*, *Aphelops malacorhinus*.

The chief similarities in these three species are found in the form of the nasals, in the proportions of the teeth, in the crests overhanging the orbits. In *A. megalodus* and *P. superciliosus* the premaxillaries are very weak, and there are no superior canines. It is not known, however, whether this is a general character of this group. The hornless and pointed nasal structure resembles that of the Aceratheriinae (*A. incisivum* and ?*Elasmotherium*) of Europe; but the skull proportions are so profoundly different that we must await further evidence.

3. Apparently a third phylum, as distinguished from the foregoing, is decidedly long-limbed, long-footed, skull dolichocephalic, brachyodont, nasals flattened, pointed, with small terminal horn rudiments. Upper Miocene, *Aphelops ceratorhinus*, *A. brachyodus*.

The association of these two species is provisional.

Much remains to be done from the more exhaustive study of the materials already in hand, as well as from the discovery

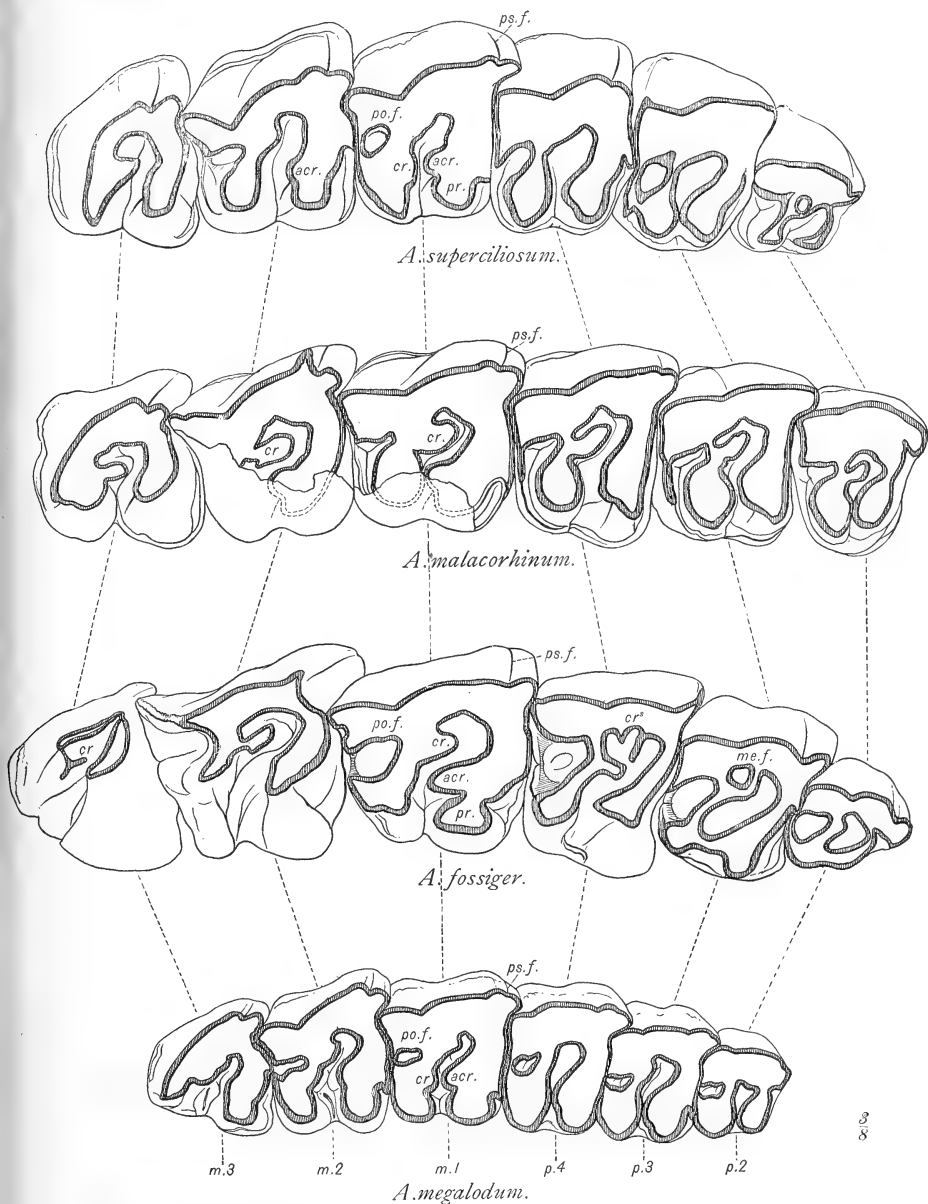


Fig. 21. Comparative series. Molars of *Aphelops megalodus* (below), *Teleoceras fossiger*, *Aphelops malacorhinus*, *A. (Peraceras) superciliosus*.  $\times \frac{3}{8}$ .

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of additional materials, especially of the skeleton, to ascertain the relations of these types as well as of the problematic species, *Aphelops profectus* (Middle Miocene), and *Cænopus persistens* (Upper Miocene).

## Article XXVIII.—NEW MAMMALS FROM VENEZUELA AND COLOMBIA.

By J. A. ALLEN.

### *Peramys brevicaudatus dorsalis*, subsp. nov.

Type, No. 16126, ♂ ad., Ciudad Bolivar, Venezuela, Dec. 19, 1899; coll. S. M. Klages.

Three adults, taken at Ciudad Bolivar in December, have been compared with the type of *P. brevicaudatus orinoci* Thomas, from which they differ in the upper surface being dark brown instead of "pale grey," and the under surface deep buff instead of "pale buffy," the hairs dingy gray basally instead of "dark slaty."

The male type measures: Head and body, 219 mm.; tail vertebræ, 79; two adult females measure, respectively, 180 and 190 in total length; tail vertebræ, 67 and 69. The corresponding measurements for the type of *orinoci*, "a slightly immature male," are 111 and 75. Skull (type), basal length, 34 (in *orinoci*, 29); greatest breadth, 19 (17); nasals, 16 x 6.5 (14.5 x 5); m<sup>1</sup>-m<sup>3</sup>, 6.3 (5.8).

Doubtless the difference in size between the types of *dorsalis* and *orinoci* is somewhat due to difference in the age of the specimens, but the important color differences can hardly be owing to the same cause, since two young specimens from Suapure (March and December) are as dark on the back as the adults.

### *Oryzomys klagesi*, sp. nov.

Type, No. 16966, ♂ (?), El Llagual, Venezuela, Feb. 19, 1901; coll. S. M. Klages, for whom the species is named.

Pelage full and long. General color above ochraceous rufous slightly varied with black-tipped hairs on the back, darker and less ochraceous on the facial portion of the head; decidedly dusky around the eyes and over front of nose; sides deep, uniform ochraceous from cheeks to rump; below buffy white, the basal portion of the fur gray; ears small, light reddish brown, nearly naked; upper surface of fore feet buff, of hind feet pale yellowish gray; tail about equal to length of head and body, pale brown, slightly paler below on the basal half, nearly naked except on the apical fifth, where fine short hairs nearly conceal the annulations and form a slight pencil at the tip.

Skull rather short (especially the rostral portion), broad and very flat, with an exceptionally broad and heavy supraorbital ledge, continued posteriorly to the interparietal as a strongly developed parietal

ridge; anterior palatine foramina relatively long and narrow, and narrow posterior nares.

Total length, 248 mm.; head and body, 127; tail vertebrae, 121; hind foot, 25 (without claws, 23); ear (from crown, dry), 12. Skull, total length, 32; basilar length, 25; zygomatic breadth, 17; interorbital breadth, 5.6; greatest width of braincase, 14; nasals, 10 x 6; palatal length, 14; palatine foramina, 6 x 2; upper toothrow, 5.

*Oryzomys klagesi* is not closely related to any species known to me. It is a robust form, with the tail rather shorter than the body, broad stout feet, rather small ears, and long soft pelage. The skull is broad and very flat, with a short, thick rostrum, and very heavy supraorbital ledges, although the teeth are almost unworn. In coloration it is remarkably like *O. speciosus* All. & Chap., from Trinidad, except for the darkening of the facial portion of the head. It is, however, a larger, more robust species, with much heavier and broader skull and shorter tail, and rather long and narrow instead of broad and short palatine foramina, and narrower posterior nares.

### *Oryzomys tenuipes*, sp. nov.

Type, No. 21330, ♀, Merida (alt. 1630 m.), Venezuela, Feb. 14, 1903; coll. S. B. Gabaldon.

In texture of pelage and coloration similar to *O. stolzmanni* Thomas, from Huambo, northern Peru, but much smaller and more delicate, with much narrower and slenderer feet, relatively shorter tail, slenderer rostrum, and shorter posterior nares.

General color above dark brown, with a tinge of rufous; sides lighter and grayer with a slight fulvous tinge; lower parts buffy whitish; ears blackish externally on the anterior border, in contrast with the color of the surrounding parts; feet very narrow and slender, upper surface of the fore feet yellowish brown, of the hind feet buffy gray; tail pale brown, apparently naked but on close inspection showing minute hairs, increasing in abundance apically until near the tip they nearly conceal the annulations and form a slight pencil.

Total length, 180; head and body, 80; tail vertebrae, 100; hind foot (with claws), 22; ear, 12. Skull, total length, 22.5; basilar length, 17; zygomatic breadth, 11.4; greatest width of braincase, 10; interorbital breadth, 3.5; nasals, 7.2 x 2; palatine foramina, 4 x 1.3; palatal length, 8.5; upper toothrow, 3. Interorbital region flat, with an angular border and slight parietal ridges; palatine foramina terminating on a line with the front molars, posterior nares very short, posterior border of palate deeply hollowed, extending well beyond the

last molars; rostral portion of skull long and narrow; bullæ pointed internally and hence subpyriform.

The skull is that of a young adult; compared with that of *stolzmanni* it is much slighter and more delicate, and fully one third less in bulk. Compared with *O. gracilis* Thomas, also from Merida, the dimensions are considerably less, especially of the skull and feet, and the pelage is not "short and velvety," but rather coarse and long, and the coloration is quite different, especially of the ventral surface, which is buffy white instead of clear white. Two other specimens agree essentially with the type. All were caught in banana plantations.

**Akodon meridensis, sp. nov.**

Type, No. 21328, ♀, Merida (alt. 1630 m.), Venezuela, Jan. 29, 1903; coll. S. B. Gabaldon.

In proportions and coloration apparently similar to *A. bogotensis* Thomas, but slightly larger and very different in cranial characters. Whole upper surface a fine grizzle or 'pepper and salt' mixture of black and fulvous, the black greatly predominating; front and sides of head more decidedly yellowish; ventral surface dingy blackish gray with strong wash of deep buff; ears of medium size, well-haired, colored like the surrounding surface; tail blackish brown above, slightly paler below, thinly clothed with blackish hairs, not quite concealing the annulations; feet blackish brown with a slight yellowish cast.

Total length, 180 mm.; head and body, 100; tail vertebrae, 80; hind foot (c. u.), 25 (dry, 23); ear, 12. Skull, total length, 26; basal length, 22.5; basilar length, 19.5; greatest breadth, 13.5; nasals, 9 x 3; interorbital breadth, 5.1; interparietal, 6 x 2; breadth of zygomatic plate, 2; diastema, 7; palatal foramina, 5 x 2; upper toothrow, 4.4. The palatal foramina reach to the middle instead of to "the front edge" of  $m^1$ , as in *A. bogotensis*.

With a general external resemblance to *A. bogotensis*, including size and proportions, *A. meridensis* has not only longer and more posteriorly produced palatine foramina, but a broader muzzle, a much broader zygomatic plate, and a longer upper toothrow. To this same group belongs also *A. frustrator* All. & Chap., from Trinidad, there being a very close agreement in size, proportions, and coloration between *A. frustrator* and *A. meridensis*, although the coloration is

distinctly not the same, and there are very obvious cranial differences, *A. frustrator* having a much narrower and more pointed rostrum, and at the same time a much broader palatal fossa.

Lives in irrigating ditches, vicinity of Merida.

20. ***Holochilus venezuelæ*, sp. nov.**

Type, No. 16973, a half grown female, El Llagual, Venezuela, March 20, 1901; cotype, No. 16964, a very old male, same locality and date; coll. Samuel M. Klages.

Adult male: General color above reddish brown, strongly varied with black along the mid-dorsal region, from nose to lower back; lighter and more fulvous on the sides, and reddish fulvous on lower back and rump; below buffy gray, the hairs gray basally with yellowish white tips, which are deep buff on the longer hairs; ears, in size, shape, and hairiness, about as in *Nectomys palmipes*; feet thinly haired, grayish flesh-colored; claws whitish with a subapical dusky ring, and fringed with whitish hairs at the base; tail dark brown, not appreciably lighter below, with short black bristles, increasing in length and abundance apically, the terminal fifth of the tail being well clothed with blackish bristly hairs, quite concealing the annulations.

The young specimen is still partly in first pelage, the middle of the back being clothed with the soft woolly first coat, of a dull rusty brown color; flanks, from cheeks to thighs, clothed with the coarser, longer, firm pelage of the mature animal, bright rusty fulvous varied slightly with black-tipped hairs; ventral surface grayish white with a slight buffy tinge superficially and gray basally. Ears rather more hairy than in the adult, the tail much less so.

*Measurements*. — Adult male: Total length, 409 mm.; head and body, 203; tail vertebræ, 206; hind foot (from dry skin), 50; without claws, 47; ear from crown (in dry skin), 16.

This species differs from *H. guianæ* Thomas, from the Kanucha Mountains, British Guiana, its nearest geographical representative, in being very much larger and more rufous as well as somewhat in cranial details. Represented by two specimens, one a very old male with the enamel pattern of the teeth obliterated, the other a young female with wholly unworn teeth. For this reason the younger specimen is designated as the type, the unworn teeth showing it to be a *Holochilus* and not a *Nectomys*; but there is no doubt that the two specimens are young and adult of the same species.



***Felis maripensis*, sp. nov.**

Type, No. 21308, ♂ ad., Maripa, Caura district, Venezuela, Dec. 7, 1901; coll. S. M. Klages.

Nape hairs directed forward. Ground color of upper parts deep tawny, nearly uniform over the whole dorsal region, the lower back and rump being scarcely paler than the neck and shoulders, but flanks slightly paler; whole upper surface heavily striped and blotched with black, the black greatly predominating over the lighter interspaces; the black markings are mostly solid, a few only, and these on the sides of the thoracic region, enclosing tawny areas, or forming rosettes; nape stripes five, very sharply defined, the middle one a narrow line, the outer pairs forming broad bands, 10 to 15 mm. wide, and extending from the top of the head to the shoulders; the narrow median stripe, except for slight interruptions at the shoulders, extends continuously to the base of the tail, with an average width of about 10 mm.; ventral surface and inside of limbs clear white, heavily blotched with black, which occupies fully half the area except on the lower abdomen; outer surface of limbs pale tawny, marked with small oval spots of black; ears externally black with the usual grayish white marginal spot; dorsal area of tail mostly black, broken by irregular cross lines of pale tawny, which divide into half rings of white on the sides and beneath.

External measurements (approximately from the softened skin): Total length, 1285 mm.; head and body, 935; tail, 350; ear, 48. The feet afford no measurements, they having been skinned out down to the toes.

Skull: Total length, 144; basal length, 130; basilar length (of Hensel), 121; zygomatic breadth, 90; breadth of rostrum at base of canines, 40; mastoid breadth, 57.5; width of braincase, 53; interorbital breadth, 27; postorbital breadth, 32.5; tip to tip of postorbital processes, 57; palatal length, 55; inner base of incisors to end of pterygoid processes, 78; width of palate at front of edge of  $p^3$ , 32; nasals very broad at anterior border, uniform wedge-shaped, 33 x 18.5; audital bullæ, 26.5 x 15; length of  $p^3$  on outer border, 17.5; width of  $p^3$ , at front border, 9.5

*Felis maripensis* is a large, dark colored form of the *F. pardalis* group, but is very different from any of the Mexican or Central American forms, and from that of the Santa Marta district of Colombia. It is characterized by the deep uniform tawny ground color of the upper parts, which closely resembles that of the jaguar; the generally solid, very coarse black markings; and the very large size of the upper carnassial

tooth and the unusually great development of its internal tubercle.

It seems presumptuous to add a supposed new cat in the *Felis pardalis* group, but the present form differs so markedly from any of those hitherto described that there seems to be no other reasonable alternative. Most of the names given to members of this group rest on very unsatisfactory descriptions based on menagerie or other specimens from unknown localities. The present species is too large to belong to the *F. pardinoides* group, and is too deeply colored and otherwise too different to be referred to any of the recently recognized forms of the *F. pardalis* group. Its Colombian neighbor on the north is a pale form, with the ground color above pale fulvous gray, rather brighter on the anterior half of the body than posteriorly, fading out to buffy grayish white on the sides, and the black stripes and blotches are very narrow, enclose large areas of the ground color, and occupy only a relatively small portion of the dorsal surface. It is also much smaller, the total length of the skull being 117 mm. and the zygomatic breadth 76. It is, however, much larger than any member of the *F. pardinoides* group, and also has the nape hairs reversed, or directed forward. Being apparently undescribed it may be called *Felis sanctæmartæ*, as described below.

***Felis sanctæmartæ*, sp. nov.**

Type, No. 14857, ♂ ad., Bonda, Santa Marta district, Colombia, March 25, 1899; coll. Herbert H. Smith.

Nape hairs reversed (directed forward). Ground color of upper parts pale grayish fulvous, stronger on head, neck, and shoulders, fading to much paler posteriorly, and to grayish white on the flanks, latter elongate and enclosing rather broad patches of pale fulvous, between the markings; black stripes and blotches very narrow, the with the intervening spaces on the sides grayish white; median nape stripe a narrow broken line of black, the outer stripes (two on each side) broad and well defined; the median black dorsal stripe is interrupted and discontinuous except for about 175 mm. along the middle region of the back; black head stripes broken posteriorly into small transverse blotches; cheek and throat stripes as usual but very narrow; ventral surface and inside of limbs white, spotted with black;

a large white ear spot; tail above blotched very irregularly with black on a dingy white ground, the black massed so as to form transverse bands of varying width on the apical third.

Total length (as measured by the collector), 927 mm.; head and body, 571; tail, 356; hind foot, 138. Skull, total length, 117; basal length, 108; basilar length (of Hensel), 101; zygomatic breadth, 76; breadth of rostrum at base of canines, 24; mastoid breadth, 50; width of braincase, 47; interorbital breadth, 21.5; postorbital breadth, 28; tip to tip of postorbital processes, 47; palatal length, 44; inner base of incisors to end of pterygoid process, 66; width of palate at front edge of  $p^3$ , 25; audital bullæ, 26 x 16.5; length of  $p^3$  on outer border, 14; width of  $p^3$  at front border, 8.

This is a very small form of the *F. pardalis* group, characterized by pallid coloration, small size, and large, evenly convex, greatly inflated bullæ. A second specimen, about half grown and still retaining part of the milk dentition, is similar in markings and all other particulars except that the coloration is a little brighter.

### *Procyon proteus*, sp. nov.

Type, No. 23492, ♂ ad., Bonda, Santa Marta district, Colombia; coll. H. H. Smith.

Coloration very variable. Type: Median dorsal region, from nape to tail, blackish varied with yellowish, the hairs being broadly tipped with black and subapically broadly ringed with fulvous; flanks golden ochraceous; ventral surface ochraceous yellow; head blackish varied with fulvous gray; a broad black band across the rostrum extends back to the eyes, and passing backward encloses the eyes, covers a broad space beneath them, and continues posteriorly to the front base of the ears, where it sends a broad arm upward to join the black area of the forehead; a broad yellowish white superciliary band, and a small oval light median spot behind the eyes; muzzle, upper lip and chin pale yellowish white; basal two thirds of ears externally dusky, the apical third and inner surface dull yellowish, heavily haired; legs dusky on the outer surface and yellowish brown on the inner; upper surface of feet pale brown, near "broccoli brown"; tail yellowish brown, strongest basally and paler apically, with above about seven black rings, and a black tip, the basal rings incomplete below.

A second male specimen is paler throughout but otherwise similar. Four females are similar in color pattern, but the dorsal area is much blacker and suffused with gray instead of fulvous, with the light facial markings white, and the flanks and ventral surface much paler, the flanks being pale fulvous instead of orange, and the ventral

surface pale yellowish white instead of yellow. In these specimens the head, neck, shoulders, and anterior half of the dorsal region are strongly blackish suffused with gray; but the amount and conspicuousness of the gray suffusion vary greatly in the different specimens.

The collector's measurements of the type are: Total length, 1041 mm.; tail vertebræ, 356; hind foot, 159; ear, 76. The four females are smaller, averaging, total length, 952 (914-991); tail vertebræ, 316 (305-330); hind foot, 138 (137-146). Skull, type: Total length, 132; zygomatic breadth, 86;  $m^1-m^3$ , 25;  $m_1-m_3$ , 29. The females are smaller, averaging 118 by 81.

The type locality of *Procyon cancrivorus* is Cayenne, to which probably the Trinidad animal is referable. A comparison of this species with a Trinidad specimen leads to the conclusion that there is very little difference in size, and probably very little in coloration, taking into account the wide variability in this respect of the Santa Marta series. But there is a striking difference in the dentition of the two forms, through the great reduction in massiveness of the teeth in *P. proteus*. This is especially noticeable in the great length of  $m_3$ , which measures  $13 \times 7.5$  in *P. cancrivorus* and  $10.5 \times 7.5$  in *P. proteus*. The upper molar series has a length in *P. cancrivorus* of 28 against 25 in *P. proteus*; the difference is still greater in the lower molar series, which measures respectively 35.6 and 30. The premolar series is especially weak in *P. proteus*, being less than half as massive as in a Trinidad example of *P. cancrivorus*; the premolars are all separated by distinct diastemata in *P. proteus*, but in *P. cancrivorus* they are closely crowded, and in the lower jaw overlap on the alveolar line.

### *Nasua phæocephala*, sp. nov.

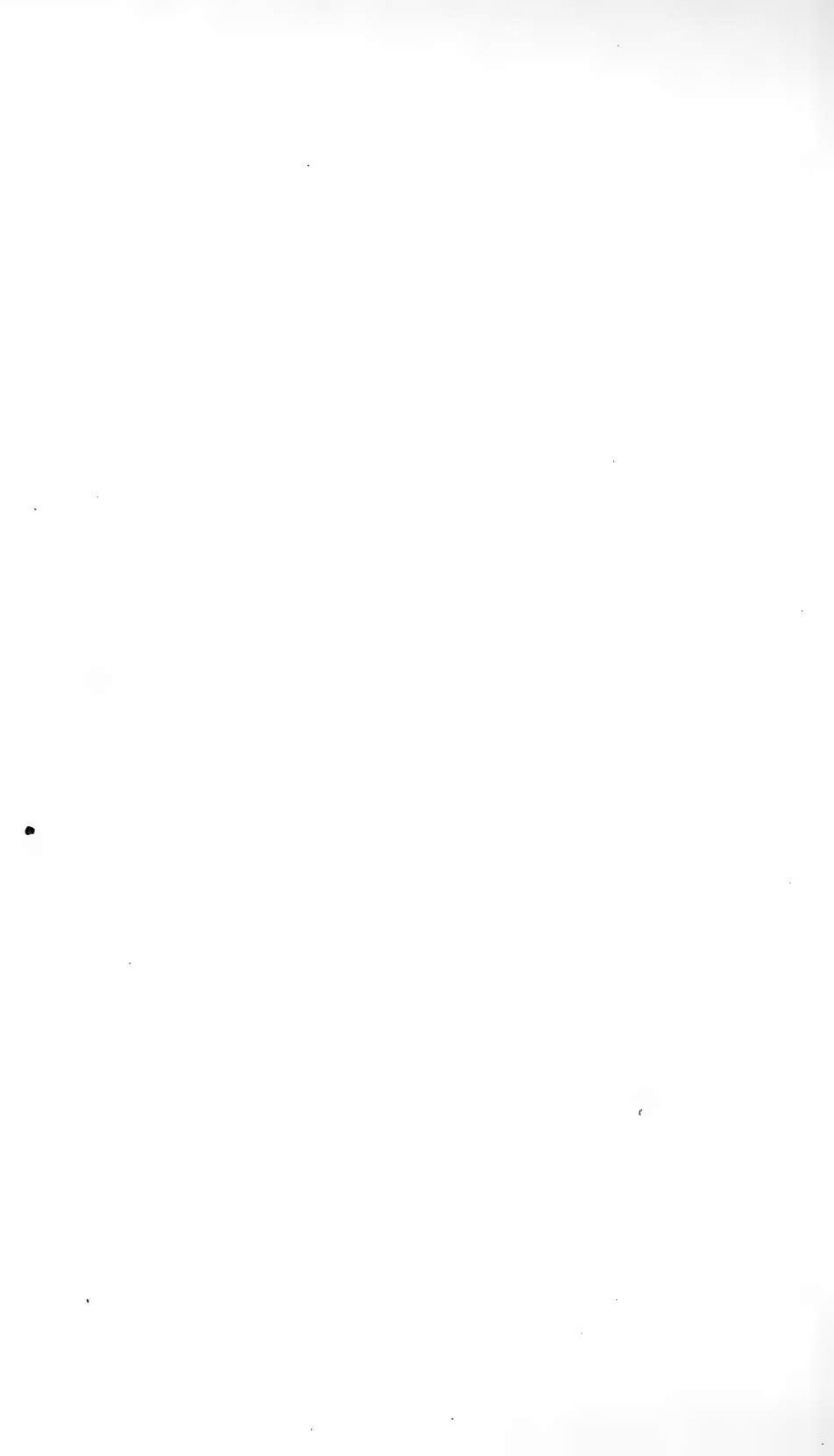
Type, No. 17557, ♀ ad., Suapure, Caura district, Venezuela, Sept. 14, 1901; coll. S. M. Klages.

Front and sides of head gray tinged with blackish, without distinct facial markings of either black or white; top of head grayish fulvous; nape, shoulders, thoracic region, and side of body dingy reddish brown, more or less shaded with dusky; posterior half of dorsal region blackish slightly mixed with dark rusty brown hairs, the dark area passing forward on the median line in a point about to the shoulders; sides of breast and lower abdomen dull rusty fulvous; costal area dull rusty

brown like the flanks, the color of the upper parts encroaching upon the ventral surface and not sharply demarked; throat with the pelage dingy brown at base and tipped with grayish fulvous, becoming still lighter on the chin; proximal portion of limbs like the adjoining parts of the body; feet and apical part of limbs black; tail conspicuously ringed with black and pale fulvous,—about eight black rings and a black tip, the black rings about twice as wide as the light rings. Pelage coarse and harsh — not fine and soft as in *N. olivaceus meridensis*.

Total length (type), 814 mm.; head and body, 495; tail vertebrae, 319; hind foot (in dry skin), 82, with nails, 88; ear (dry), 26. Skull. Total length, 121; basal length, 119; basilar length (Hensel), 103; zygomatic breadth, 60; interorbital breadth, 25; postorbital breadth, 26; mastoid breadth, 42; width of braincase, 43; nasals — (imperfect in type); incisors to pterygoid process, 81; upper toothrow (c-m<sup>3</sup>). 46.5; middle molar (m<sup>2</sup>), 7 x 7; audital bullae, very convex anteriorly, 15 x 9. This skull is practically of the same size as female skulls of corresponding age of *N. 'nasua'* from Chapada, Matto Grosso, Brazil, but the teeth are much larger, m<sup>2</sup> being 1 mm. larger in both diameters, and the bullae are longer and narrower and more convex anteriorly.

This form of the *N. nasua* group appears to be well characterized by its gray head and the absence of facial markings, its coarse harsh pelage, general coloration, and heavy dentition. Represented by the type, an adult female, and a young but nearly adult male, both taken at Suapure on the same day. They agree very closely in all details of coloration.



**Article XXIX.**—LIST OF MAMMALS FROM VENEZUELA,  
COLLECTED BY MR. SAMUEL M. KLAGES.

By J. A. ALLEN.

During three years — 1900–1902 — Mr. Samuel M. Klages, a well-known entomological collector, collected birds and mammals for this Museum in Venezuela, incidentally to his other work. The collection of mammals, which forms the subject of the present paper, includes 275 specimens, representing 46 species. Some were collected in the immediate vicinity of Ciudad Bolivar, but the greater part at Maripa, Suapure, and other points in the Caura Valley.

1. **Marmosa klagesi** *Allen*. — Ciudad Bolivar, 3 specimens, 2 adult and 1 young, Oct. 26, Nov. 13, and Jan. 2; La Union, 3 specimens, 1 adult female and 2 young, May 4 and June 7. (See this Bulletin, XII, 1900, p. 198.)

2. **Marmosa mitis** *Bangs*. — Ciudad Bolivar, 1 specimen, Sept. 11. Indistinguishable from Santa Marta, Colombia, specimens.

3. **Marmosa murina** (*Linn.*). — Suapure, 1 specimen, Nov. 17.

4. **Peramys brevicaudatus dorsalis** *Allen*. — Ciudad Bolivar, 3 adults, taken in December, and 2 young from Suapure, March 25 and Dec. 15. (See this Bulletin, XX, 1904, p. 327.)

5. **Caluromys trinitatis leucurus** *Thomas*. — Ciudad Bolivar, skin and skull, adult male, Oct. 15; Suapure, skull only of a half-grown specimen, March 25.

6. **Metachirus nudicaudatus** (*E. Geoffroy*). — Maripa, 1 specimen, adult female, Feb. 28.

7. **Didelphis marsupialis** *Linn.* — Ciudad Bolivar, 1 specimen, a female about one third grown, Jan. 11.

8. **Bradypus tridactylus flaccidus** (*Gray*). — Nine specimens, collected as follows: Ciudad Bolivar, 3 specimens, 2 of which are adult females and the other a young female about one third grown, Jan. 25 and Feb. 6; Suapure, 4 specimens, 3 adult females and a young female, Sept. 11, Oct. 20, and Feb. 17;

October, 1904.]

Maripa, 2 specimens, adult female and young, Dec. 28, and Jan. 30.

No. 16135, ♀ ad., the whole front and sides of the head are covered with erect, stiff, bristly hairs, very different from the coarse, long, soft hairs of the rest of the pelage. These hairs are shorter on the face in front of and around the eyes, longer and stiffer over the top of the head, and still longer and less rigid on the sides of the head, neck, and throat. The coloration of the 'mask' is peculiar, being yellowish white on the front border, passing into golden ochraceous over the top and sides of the head and on the throat, enclosing a large circular area of ferruginous chestnut on the side of the head behind the eyes. There is also a narrow blackish eyering and a short, well-defined blackish postocular stripe. Top of head and nape, back to shoulders, blackish brown; rest of upper parts mixed blackish brown and dull soiled grayish white, which coloration extends onto the outer surface of the limbs; rump yellowish gray, unmixed with blackish; ventral surface and inside of limbs lighter than sides — dingy gray with less admixture of dusky hairs. A median black line is continued back over the shoulders from the nape, with a yellowish white stripe on each side. The hairs of the front part of this black dorsal band are much finer and softer than those of the general pelage, and the woolly underfur of the adjoining whitish bands is suffused basally with a golden tint. Claws white at tip, the basal two thirds yellowish.

No. 16136, ♀ ad., Feb. 6, is similar but the colors in general are everywhere paler, with the light colors prevailing over the dark tints. There is, however, a general difference in the character of the dorsal patch, which is sharply defined by the different character of the hair as well as by its strikingly contrasting colors. This patch has a length of 70 mm. by a width of about 35 (as measured from the dry unfilled skin), and is long oval in outline. The hair, evidently new, is short and stiff, like that on the mask, being only about 10 mm. in length, in striking contrast with the adjoining loose flaccid hairs 30–50 mm. long. The patch is divided by a median band of deep black, varying in width from 7 to 20 mm., being widest anteriorly and narrowest in the middle, and flanked on either side by a much wider band of ochraceous orange.

No. 16134, ♀ juv. (about one third grown), Jan. 25. This closely resembles in coloration and texture of pelage No. 16135, but the tints are paler, and the hair rather softer.

The 6 adults of this series, all sexed by the collector as females, vary greatly in the color of the dorsal surface, some being much lighter than others, with the dark color arranged in irregular patches. Three of them have the bright-colored,



conspicuous, chestnut and black post-interscapular patch of short stiff hair described above under No. 16136; two are quite without any such differentiation of the color and texture of the hairs of this region, while the other has the black hairs on this area shorter and softer than those of the adjoining pelage. Apparently, therefore, the presence or absence of this highly differentiated patch is not sexual, nor does it appear to be seasonal, as those with the patch were collected, respectively, Sept. 11, Jan. 30, and Feb. 6, while those without it were taken, respectively, Oct. 20, Dec. 30, and Jan. 25. It may, however, have some relation to the period of reproduction, which seems to vary with the individual, since a half-grown young was taken Dec. 28, and two others much younger were collected, respectively, Jan. 25 and Feb. 17.

These specimens are presumed to be referable to *Arctopithecus flaccidus* Gray (P. Z. S., 1849, p. 72, pl. xi, fig. 1), the type of which is the Dyson specimen from Venezuela, afterwards renamed *Arctopithecus flaccidus*, var. 1, *dysoni* by Gray in 1869 (Cat. Carn., Pachy., and Edent. Mamm., 1869, p. 365), and still later (1871) *Bradypus columbicus* by Fitzinger.

9. ***Cholœpus didactylus*** (Linn.). — La Union, 1 specimen, adult female, June 2.

10. ***Cyclopes didactylus*** (Linn.). — Ciudad Bolivar, 1 specimen, female, Aug. 10; San Egidro, 2 specimens, male and female, Feb. 6.

11. ***Tamandua longicaudata*** (Wagner). — Five specimens, collected as follows: El Llagual, 1 specimen, May 7; Suapure, 1 specimen, Feb. 8; Maripa, 3 specimens, Nov. 30 and Jan. 18.

These five specimens of the Yellow Tamandua are very different in cranial characters as well as in coloration from the common *Tamandua tetradactyla*, and show beyond question that the species is well-founded, although the tail is not "nearly double the length of the body," as stated by Turner (P. Z. S., 1851, 218), the relative length of the tail to the body being apparently about the same as in *T. tetradactyla*, as given by Wagner (Suppl. Schreber's Säug., IV, 1844, p. 210). The ears, however, are much longer and larger.

Four of these specimens show no trace of the dark color

markings of the common tamandua, the coloration being nearly uniform yellowish brown, but varying from light straw color to much darker in different individuals. In the other specimen the nape, shoulders, and middle of the body all around are dusky with the tips of the hairs yellow, and a narrow median line of yellow extending from the shoulders to the hips. This specimen strongly suggests the color pattern of the common tamandua. The skull is larger than in *T. tetradactyla*, with the rostral portion slenderer and relatively longer, and the nasals are not abruptly expanded at the posterior border, as is usually the case in *T. tetradactyla*.

All the specimens of *Tamandua* sent by Mr. Klages are of the *T. longicaudata* type.

12. **Myrmecophaga tridactyla** Linn. — Ciudad Bolivar, 1 specimen, skin and skull, Jan. 7; Maripa, 2 specimens, — skeleton, Dec. 5, and skin and skull, Nov. 26.

13. **Mazama rufa** (F. Cuvier). — Three specimens: 2 adult females, Maripa, July 8 and Aug. 21; a young male, Suapure, Aug. 21.

14. **Sciurus flammifer** Thomas. — Thirteen specimens, collected as follows: Suapure, 5 specimens, Feb. 14 and 15; El Llagual, 2 specimens, March 18 and 20; La Union, 6 specimens (topotypes), Oct. 18.

The 5 Suapure specimens and one of the 6 La Union specimens are in the normal pelage of the type; the 2 El Llagual specimens and 5 of the La Union specimens are melanistic. In one of these the ventral surface is white; in another the hairs of the ventral surface are dusky at base and conspicuously tipped with white; in all the others the ventral surface is dusky, tinged with chestnut in two. There are traces of the orange-rufous lateral line in several of the melanistic specimens. The normal specimens are all white-bellied.

15. **Sciurus æstuans gilvularis** (Wagner). — Six specimens: Suapure, 4 specimens, Feb. 6–13 and Sept. 16; La Union, 1 specimen, Oct. 21; El Llagual, 1 specimen, March 23. The September and October specimens are much deeper orange buff below, and more of a reddish cast above than the

February and March examples, from practically the same localities.

I am unable to satisfactorily distinguish these specimens from Santarem examples of *S. gilvicularis*.

16. ***Mus alexandrinus*** *Geoffroy*. — One specimen, Ciudad Bolivar.

17. ***Oryzomys klagesi*** *Allen*. — One specimen, El Llagual, Feb. 19. (See this Bulletin, XX, 1904, p. 327.)

18. ***Sigmomys alstoni*** (*Thomas*). — El Llagual, 1 specimen, adult female, March 2.

19. ***Zygodontomys stellæ*** *Thomas*. — El Llagual, 5 specimens (2 males, 3 females), all adult, March 12-23.

These specimens agree well with the description of *Z. stellæ* except as regards some of the external measurements, namely, "head and body, 110 millim.; tail, 38." But, "Tail about equal to the body without the head" is also not in harmony with these proportions. The description otherwise, including the dimensions of the skull, etc., agrees with the present series. The collector's measurements are: Head and body, 2 males, 133, 148; 3 females, 118-127; tail vertebræ, 2 males, 102, 108; 3 females, 83-98; average for the whole series, 130, 98. Skull, total length, 29-31. Although all are adult, the larger specimens, with the teeth greatly worn, are much older than the smaller examples.

20. ***Holochilus venezuelæ*** *Allen*. — El Llagual, 2 specimens, a very old male and a half-grown female, March 20. (See this Bulletin, XX, 1904, p. 330.)

21. ***Proechimys cherriei*** (*Thomas*). — Seven specimens, El Llagual, March 18-23.

22. ***Dasyprocta lucifer*** *Thomas*. — One specimen, an adult male, El Llagual, March 14. Head and body, 520 mm.; tail, 32; skull, greatest length, 115; zygomatic breadth, 51.

23. ***Felis onca*** *Linn*. — One specimen, Maripa.

24. ***Felis maripensis*** *Allen*. — One specimen, adult male, Maripa, Dec. 7. (See this Bulletin, XX, 1904, p. 331.)

25. ***Canis*** (*Thous*) ***cancrivorus*** *Desmarest*. — Two specimens, adult male and female, Suapure, Feb. 9.

Mr. Klages's collection contains 5 specimens of *Canis* of the

*cancrivorus* group, two of which are from Suapure and three from Maripa. The Suapure specimens are larger (on the basis of the skulls) and grayer than the Maripa animals, with much less rufous suffusion. These, in the absence of Guiana specimens for comparison, I provisionally refer to the coast form, *cancrivorus*. They are gray above, heavily varied with black along the middle of the back and upper surface of the tail, with little buffy suffusion, even of the underfur, and this mainly restricted to the sides of the neck, below and behind the ears; below buff, paler on the breast and inguinal region; chin blackish, the black extending back for 175 mm.; limbs yellowish buff, strongest on the sides and washed with blackish on the anterior surface. Total length, ♂ 958; ♀ 933; head and body, ♂ 660, ♀ 635; tail vertebræ, ♂ 298, ♀ 305; hind foot (approximate from dry skin), ♂ 144 (with claws 150), ♀ 144 (with claws 150); ear (dry), ♂ 62, ♀ 60. Skull, total length, ♂ 148.5, ♀ 145.5; basal length, ♂ 139, ♀ 138; zygomatic breadth, ♂ 82, ♀ 77.

The other three specimens agree well with the description of *Canis cancrivorus savannarum* Thomas, except that they are a little larger; they are provisionally referred to that form, as follows:

26. **Canis (Thous) cancrivorus savannarum** Thomas. — Three specimens, two adult males, Maripa, Dec. 24 and 29, and a half-grown female, Maripa, Aug. 1.

The December specimens are in greatly worn pelage, the long hairs on the back in one of the specimens and on the tails in both being greatly worn. In fresh pelage the whole back from the shoulders posteriorly is evidently strongly varied with black, as in the Suapure specimens. The underfur is strongly instead of faintly suffused with buff, brightening to orange buff on the neck, including the region of the ears and top of the head; pectoral region, insides of limbs, and the tail (except median line above), also deep orange buff; the rest of the ventral surface deep buff. Even the surface color on the sides of the neck and the area surrounding the ears is deep rusty buff.

As already said, these specimens are smaller than those

from Suapure, of corresponding sex and age, and besides being markedly different in coloration,  $m^2$  is disproportionately smaller and less produced internally. The adult specimens respectively measure: Total length, 965, 973; head and body, 686, 668; tail, 279, 305; hind foot (approximately from dry skin), 140 (with claws 150), 140 (with claws 148); ear (dry), 50, 48. Skull, total length, 137, 134; basal length, 129, 130; zygomatic breadth, 76, 74. These measurements being of males naturally exceed those given of the female type of *savannarum*.

*Canis aquilus* (= *Urocyon aquilus* Bangs), from the coast region of Colombia, while strongly resembling externally the present group, differs from it in the skull being relatively broader and shorter with rather heavier dentition. While specifically distinct from *C. cancrivorus* it has only the most remote relationship to the genus *Urocyon*, which is suggested only by its coloration and coarse pelage.

27. **Tayra barbara** (Linn.). — Suapure, 2 specimens, Feb. 9 and 13.

28. **Nasua phaeocephala** Allen. — Two specimens, adult female and young adult male, Suapure, Sept. 14. (See this Bulletin, XX, 1904, p. 334.)

29. **Myotis nigricans** (Wied). — Forty specimens, Maripa, Dec. 10–23.

30. **Proboscidea naso** (Wied). — Seven specimens, Maripa, Dec. 7–11, and Mato River, Feb. 24.

31. **Saccopteryx bilineata** (Temm.). — One specimen, Suapure, April 20.

32. **Myopterus planirostris** (Peters). — Two specimens, Maripa, Dec. 9 and 10.

33. **Molossus obscurus** E. Geoffroy. Seventy-five specimens, — 25 from Ciudad Bolivar, Sept. 30–June 26; 50 from Suapure, December.

34. **Molossus pretiosus** Miller. — Twenty-four specimens, — 13 from Ciudad Bolivar, Sept. 27–Oct. 13; 11 from Suapure, April 15.

35. **Promops barbatus** Allen. — One specimen, La Union, Caura district, Sept. 27. (See this Bulletin, XX, 1904, p. 228.)

36. **Dermanotus suapurensis** *Allen*. — One specimen, Suapure, Oct. 26. (See this Bulletin, XX, 1904, p. 229.)

37. **Lonchophylla thomasi** *Allen*. — One specimen, Ciudad Bolivar, Jan. 26. (See this Bulletin, XX, 1904, p. 230.)

38. **Micronycteris megalotis** (*Gray*). — One specimen, Ciudad Bolivar, Oct. 18.

39. **Hemiderma perspicillatum** (*Linn.*). — Two specimens, Ciudad Bolivar, May 20 and October 23.

40. **Phyllostomus hastatus** (*Pallas*). — Twelve specimens, — 1 from Ciudad Bolivar, Oct. 16; 11 from Suapure, April 15, of which 7 are young, about one half to two thirds grown, still retaining some of the milk incisors. They are all in young pelage, and all are very dark brown, or blackish brown.

41. **Phyllostomus discolor** *Wagner*. — Two specimens, Ciudad Bolivar, August 12, and Suapure, Nov. 17.

42. **Artibeus planirostris** (*Spix*). — Two specimens, Ciudad Bolivar, May 25 and September 2.

43. **Uroderma bilobatum** *Peters*. — Three specimens, 1 from Ciudad Bolivar, Sept. 27; 2 from Suapure, Nov. 17.

44. **Sturnira lilium** (*E. Geoffroy*). — Two specimens, Suapure, April 15, and Maripa, Dec. 9.

45. **Ateles belzebuth** *I. Geoffroy*. — One specimen, La Union, Caura district, Aug. 15 — an old female with greatly worn teeth.

46. **Cebus fatuellus** (*Linn.*). — Four specimens, of which 1 is from Suapure, taken Oct. 26; 1 from La Union, Oct. 9; 1 from El Llagual, March 12; and 1 from Maripa, April 21.

These four specimens well sustain the reputation of this species for variability, no two of them being very nearly alike.

The Suapure specimen (Oct. 26) is an old male in excellent pelage, with well developed lateral crests or 'horns'; and the hair of the flanks is very long. It has the top of the head deep brownish black; the nape, shoulders, and front half of the back dark brown with the tips of the hairs yellowish brown; lower back and rump dark reddish brown with the tips of the hairs yellowish rufous, making this tint the prevailing shade; limbs externally yellowish brown, with the upper surface of the feet and hands blackish brown; throat pale yellowish; sides of face yellowish gray; ventral surface chestnut rufous; inside of shoulders and inside of upper arms rusty yellow;

inside of thighs strongly reddish brown; tail yellowish brown, darker apically, the hairs individually being blackish brown for most of their length and broadly tipped with yellowish gray.

Another old male from El Llagual (March 12) has the pelage considerably worn, and perhaps for this reason presents only a tendency to lateral crests—more so on one side than on the other—which apparently had been either shed or worn away. The general coloration of the dorsal surface, tail, and outside of limbs is very similar to that of the Maripa specimen, but the light tips of the hairs are paler, more yellowish, and less rufous. The ventral surface, however, is quite different, the remaining hairs of the breast and abdomen (which are nearly naked) being brown with a slight reddish cast, while the shoulders and upper arms are pale buff instead of rusty yellow.

An old female from La Union (Oct. 9) is in good pelage but lacks the lateral crests. The crown and middorsal region from nape to tail are brownish black with a slight rufescent tinge, the hairs very slightly tipped with dull rusty yellow. The under surface is about as in the La Union specimen, with the buffy tints several shades stronger.

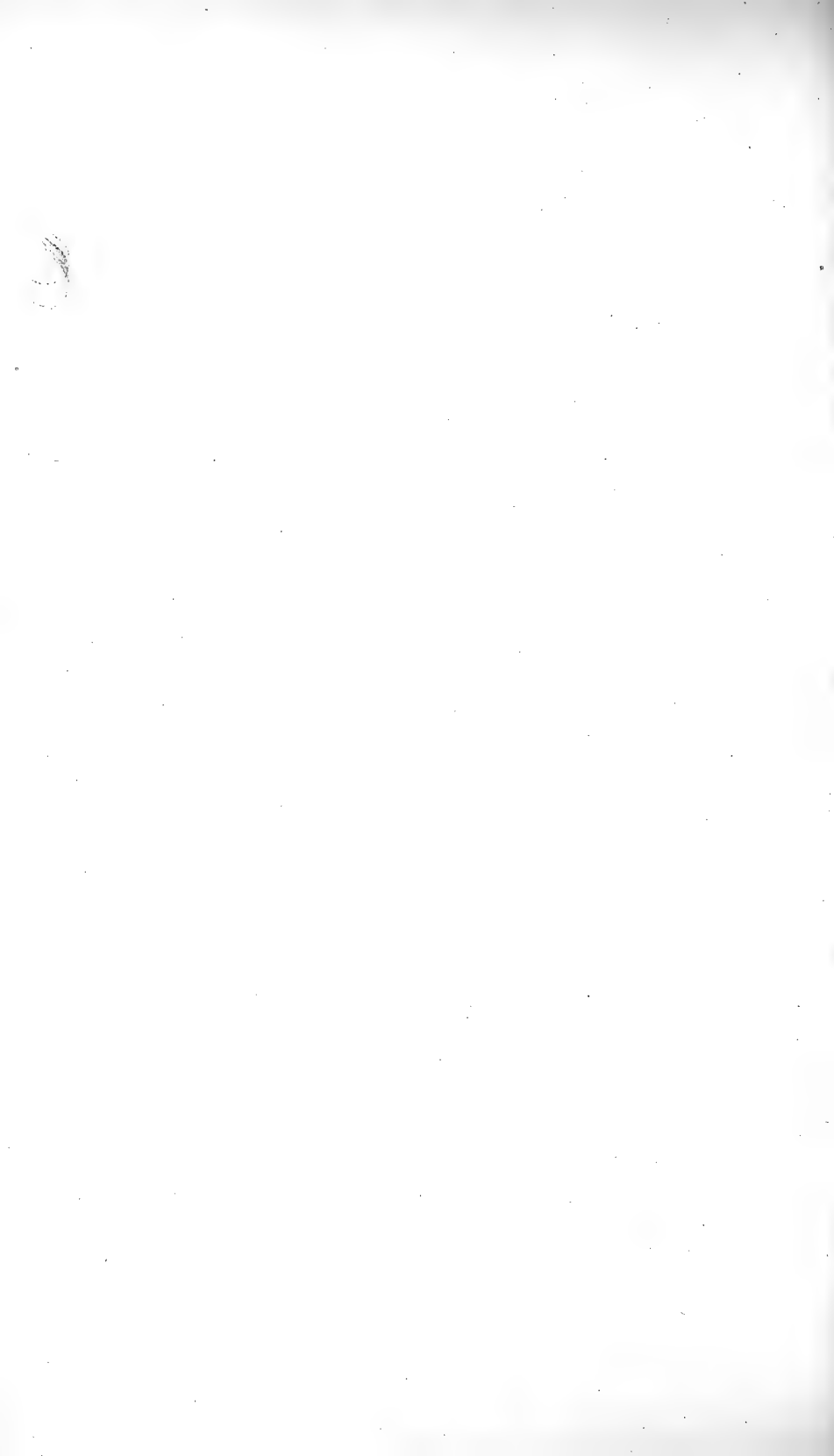
An old female from Maripa (April 21) is in very worn pelage and evidently much faded, the light color on the sides of the face and chin being soiled grayish white and on the shoulders and upper arms very pale buffy white. The dark color on the top of the head forms a wedge-shaped median band, beginning as a mere line and widening gradually as far back as the ears where it occupies about two thirds of the interaural space.

The collector's external measurements are as follows:

16930, old ♂, Suapure;	head and body, 445;	tail vertebræ, 496,
16929, ad. ♂; El Llagual;	" " 445;	" " 508.
17559, old ♀, La Union;	" " 425;	" " 572.
16931, ad. ♀, Maripa;	" " 381;	" " 406.

The skulls, while all adult, vary much in age, No. 16930 being a very old male, and also in size, as follows:

16930, old ♂, total length, 102;	zygomatic breadth, 66.
16929, ad. ♂, " " 93;	" " 60.
17559, old ♀, " " 89;	" " 59.
16931, ad. ♀, " " 87;	" " 55.





## Article XXX. — A NEW TYPE OF SOCIAL PARASITISM AMONG ANTS.

By WILLIAM MORTON WHEELER.

The observations recorded in the following paper were made during the summers of 1901, 1902, and 1904 at Colebrook in the Litchfield Hills of Connecticut, in the same locality in which I first observed the singular symbiotic relations of *Leptothorax emersoni* and *Myrmica brevinodis*, published in two previous papers.<sup>1</sup> The contents of the present paper relate to a hitherto unrecognized type of symbiosis between colonies of two very different ants, *Formica consocians* and *F. incerta*, and are of a nature to modify our views on some of the mixed colonies formed by other species both in Europe and America. Before taking up the relationship of the two species to each other it will be advisable to devote a few paragraphs to their taxonomic and ethological peculiarities.

*Formica incerta* is regarded by Emery as a variety of *F. schaufussi* Mayr, which, in turn, he regards as a subspecies of *F. pallide-fulva* Latreille, a very variable and distinctively North American form. In reality, *incerta* may be said to represent a transitional form between *schaufussi* and the subspecies *nitidiventris* Emery, having the coloration of the latter, and, to a limited extent, the pilosity of the former subspecies. In other words, *incerta* is apt to be somewhat darker than *schaufussi*, but has a few erect hairs on the lower surface of the head and the margin of the petiole.<sup>2</sup>

All three of these forms construct the same kind of a nest, which is almost invariably under a stone. For this purpose a flat stone, not too deeply embedded in the soil, is preferred. There are a number of broad chambers and passages in the surface soil and a few vertical galleries extending down from these to a depth of about a foot or eighteen inches. The walls

<sup>1</sup> The Compound and Mixed Nests of American Ants. Am. Nat., Vol. 35, Nos. 414, 415, 417, and 418, 1901, and Ethological Observations on an American Ant (*Leptothorax emersoni* Wheeler). Journ. für Psych. und Neurol., Bd. 2, Heft 1 u. 2, 1903.

<sup>2</sup> See Appendix A.

of the galleries and chambers are smoothly finished off and can hardly be mistaken for the work of any of our other species of *Formica*. The instinct, so pronounced in our other species of this genus, especially in the *rufa* group, of banking the edges of the stones with vegetable débris, is absent or extremely feeble. The colonies are small. Even the most populous contain hardly more than 500 workers, and the number, especially in the case of *incerta*, is commonly not more than half as great as in the typical *schaufussi*. A single colony may contain from one to five queens. The pupæ are less frequently naked than in some of our other species. The males and winged females normally make their appearance during July.

As would be expected from the small size of the colonies, the workers are very timid and usually make no attempt to defend their nest. They run with great rapidity, so that within a few moments after the nest is uncovered, all the workers have disappeared into the galleries or the surrounding grass. From the apertures of the former they sally forth, snatch up their larvæ and cocoons and retreat without confusion or any loss of time.

In the Litchfield Hills, *F. incerta* is much more abundant than the typical *schaufussi*. Both show a marked preference for the sunny upland pastures sloping towards the east and south at an altitude of 1000–1400 feet.

*F. consocians* is a very different ant. It is clearly a variety of *F. difficilis* Emery, which was regarded by its author as a subspecies of *F. rufa* L. But the name indicates that Emery had some doubts concerning the taxonomic status of the form. He described briefly all three phases and called attention to the extraordinary characters of the female. This sex, in being very small and uniformly yellow, departs so widely from the females of other forms assigned to *rufa*, that I do not hesitate to regard *difficilis* as a distinct species. At the same time there can be no doubt that it is very closely related both in structure and habits to the ants of the *rufa* group. The new variety *consocians* is described at length in Appendix B.

Like *incerta*, *consocians* nests under stones, but prefers heaps or clusters of stones, the edges and interstices between which are filled by the ants with abundant vegetable débris. The galleries are small and irregular and often carried out among the grass-roots surrounding the nests. These galleries differ greatly in appearance from the finished excavations of *incerta*. When fully developed the colonies are so populous that they may contain many hundreds or even several thousand workers and, during August, a great number of worker pupæ, always, so far as I have observed, enclosed in cocoons. The males and winged females make their appearance during the early part of August. Numerous males were found in a large colony Aug. 12, 1901, but none of the winged forms could be found during the latter half of the same month of the current year.

The workers of small colonies are as timid as those of populous ones are bold and pugnacious. The latter furiously defend their nest with their mandibles and formic acid batteries. When employing the latter they rise on their hind legs and bend the tip of the gaster forward in the attitude so characteristic of *F. rufa*, *integra*, etc. The gait of the workers is rather slow and hesitating, just as it is in the various forms of *rufa*. The females, on the other hand, are extremely timid, highly heliophobic, and run rapidly and without hesitation. The slightest disturbance of the nest causes them to disappear into the grass or the lower galleries, so that seeking the deälated queens of *consocians* in a populous colony is if anything more difficult than trying to find a needle in a haystack.

Both *difficilis* and its variety are mountain ants, the former occurring further to the south (in North Carolina and Virginia), the latter to the north (in Connecticut and possibly also in New Jersey). In the Litchfield Hills the var. *consocians* was not to be found at a lower altitude than 1200 feet. It prefers the same sunny upland pastures or glades interspersed with thickets as *incerta*. I have taken it in only three localities: on Mt. Pisgah (alt. about 1440 ft.) and on two neighboring hills (1200–1300 ft.) where *incerta* happened to be unusually abundant.

Although I had seen the colonies of *consocians* and *incerta* during previous summers, I failed to perceive any relationship between the two species till the past August, when, on going to Colebrook for a fortnight's vacation, I began to look for the small females of the former on account of their resemblance to the even smaller females I had described for *F. microgyna* of Colorado and Utah.<sup>1</sup> While engaged in this search I happened on certain mixed colonies of the two species, and forthwith concentrated my attention on them to the almost complete exclusion of other ants. I give my field observations in very condensed form together with notes on four colonies from my note-book of 1901. At that time I mistook the small queens of *consocians* found in two *incerta* nests for microgynes of the latter species, and as such they were described by one of my former pupils, Miss Margaret Holliday.<sup>2</sup> In the following paragraphs the observations are arranged irrespective of dates, so as to present a sequence of stages from the establishment of the *consocians* colony till its complete development. All of the colonies were found under stones, and all, with the exception of Nos. 2, 6, 10, and 11, within an area of four or five acres on the southern and eastern slopes of Mt. Pisgah. All of the *consocians* females mentioned were deâlated and therefore presumably fertile queens.

1. Aug. 15, '04. A small colony of *incerta* comprising about 30 workers. On raising the stone about a dozen workers were seen dragging a *consocians* queen by all her legs and antennæ through one of the superficial galleries. She was still alive when rescued from her tormentors. On digging into the nest I found an *incerta* queen and several worker pupæ.

2. Aug. 25, '01. A small colony of *incerta* workers (number not recorded) and two *consocians* queens. There was no *incerta* queen.

3. Aug. 18, '04. A small colony of *incerta* comprising about 25 rather small workers, a few larvæ and pupæ of the

<sup>1</sup> Extraordinary Females in Three Species of Formica, with Remarks on Mutation in the Formicidæ. Bull. Mus. Nat. Hist., Vol. 19, Nov. 21, 1903; pp. 645-649.

<sup>2</sup> A Study of Some Ergatogynic Ants. Zoolog. Jahrb. Abth. f. Syst. etc., 19 Bd., 4 Heft, 1903, p. 313.

same species, and a single *consocians* queen. The latter was unearthed at a depth of 9 inches. The colony contained no *incerta* queen.

4. Aug. 23, '04. A small colony consisting of about 15 *incerta* workers and a single *consocians* queen. There were about 8 worker cocoons of *incerta*, but no queen of this species.

5. Aug. 19, '04. A small colony comprising only 11 *incerta* workers, a *consocians* queen, unearthed at a depth of 5 inches, but no *incerta* queen. There were a few *incerta* cocoons in the nest.

6. Aug. 19, '01. A small colony found at North Colebrook. It comprised a few small *incerta* workers and a single *consocians* queen.

7. Aug. 21, '04. A small colony comprising only 8 or 9 *incerta* workers, although the size of the nest showed that it must have contained a larger colony at some former time. On removing the stone a *consocians* queen was seen in the upper chambers but at once disappeared into one of the galleries and was unearthed at a depth of 9 inches. There were a few *incerta* cocoons, but no queen of this species.

8. Aug. 29, '04. A small colony containing 10 *incerta* workers of rather small size, one small *consocians* worker, and a few worker cocoons which gave rise to both *incerta* and *consocians* workers on being kept in an artificial nest. A *consocians* queen was unearthed at a depth of 6 inches. There was no *incerta* queen.

9. Aug. 15, '04. A small colony comprising about 75 *consocians* workers and a dozen *incerta* workers. There were numerous cocoons of *consocians* workers and a fine queen of this species. There was no *incerta* queen.

10. Aug. 6, '01. A small colony found under two large stones. Only workers of both species were found (number not recorded). There were no larvæ but several worker cocoons and callows of *consocians*. No queens were found. A *consocians* queen may have been present but was, in that event, overlooked.

11. Aug. 25, '01. A small mixed colony comprising *consocians* and *incerta* workers in the proportions of about 20 of

the former to one of the latter. There were some small larvæ (probably *consocians*). No queens were found, that of *consocians* having been probably overlooked as in the preceding observation.

12. Aug. 17, '04. A nest clearly of the *incerta* type, as shown by the flat superficial chambers and large vertical galleries, containing about 150 *consocians* and only 4 *incerta* workers. The latter were unearthed at a depth of 14 inches. There were a few *consocians* worker pupæ and callows. Failed to find a *consocians* queen, which may have escaped.

13. Aug. 29, '04. A colony containing about 200 *consocians* and 5 *incerta* workers. The nest was of the pure *incerta* type, but a small *consocians* nest inosculated with it at the edge of the stone where the galleries had been excavated between the grass-roots and covered with vegetable débris. The *consocians* workers slunk away timidly, even forsaking quite a number of their cocoons. The queens of neither species were found. It is probable that a *consocians* queen belonged to the nest but escaped my notice.

14. Aug. 18, '04. A well-excavated *incerta* nest, passing over at the edge of the stone into a typical *consocians* nest as in the preceding observation. The galleries of both nests were inhabited in common by about 50 *incerta* and 150 *consocians* workers. A female of the latter species was found without difficulty, but none of the former. There were many worker cocoons and callows, but all belonged to *consocians*. The stone was carefully replaced. When the colony was revisited on the following day (Aug. 19), all the *consocians* and some of the *incerta* had moved away with the cocoons, but about a dozen of the latter species were still loitering about the galleries.

15. Aug. 18, '04. A nest of the pure *incerta* type but containing only *consocians*, a single queen and about 200 workers, and several worker cocoons. After unearthing all the rest of the colony, the queen was found at a depth of 8 or 9 inches in the lowermost galleries of the nest.

16. Aug. 29, '04. A nest of the typical *consocians* type under a single large stone and containing about 300 workers

of this species. I failed to find the queen. Under the same stone and inosculating with the *consocians* nest were the unmistakable but completely deserted galleries of an *incerta* nest. Workers of the latter species were nowhere to be found.

17. Aug., 1900, 1901, and 1904. Several large and pure *consocians* colonies containing many hundreds of workers and their cocoons. These colonies were always located in piles of stones that had been banked with vegetable débris by the ants.

The colonies above described may be separated into six groups, represented respectively by No. 1, Nos. 2-7, Nos. 8-12, Nos. 13 and 14, Nos. 15 and 16, and No. 17. Colonies 1-7 show that the young fertilized *consocians* queen enters a small and either incipient or depauperate *incerta* colony. She is not always amicably received, as shown by the behavior of the workers in colony No. 1. But in the series this is the only one that contained an *incerta* queen. In all the other cases the relations between the *consocians* queen and the *incerta* workers were perfectly cordial, as was proved whenever the insects were kept in artificial nests.

Colonies 8-12 show that the offspring of the *consocians* queen are reared in the *incerta* nest, without doubt by the workers of the latter species. This series of colonies also indicates that the number of host ants dwindles or remains constant, or at any rate does not increase *pari passu* with the increase of the *consocians* workers.

Nos. 13 and 14 show that after the *consocians* colony has acquired a certain strength and status it begins to construct its own characteristic nest to one side of the *incerta* nest in which it was reared.

Colonies 15-17 show that the *consocians* colony, when it becomes sufficiently populous, emancipates itself completely from the host species, so that there is nothing to suggest its parasitic origin.

Finally, in view of the fact that *F. consocians* is by no means a common or dominant species, the above observations are sufficient to prove that the method of colony formation here suggested is neither abnormal nor accidental, but the regular

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if not the only method. Nevertheless field observations leave doubtful certain questions which can be answered only by recourse to observations and experiments on colonies kept in artificial nests. We should naturally wish to ascertain the effects of artificially introducing strange *consocians* queens into *incerta* colonies with and without their own queens. And these experiments should be tried with *consocians* queens that have been living under three conditions: first, as young fertilized individuals that have just left the parental nest, second, as females that have been living with other *incerta* colonies, and third, as old queens that have long been living in pure colonies of their own species. As the season was far advanced when I first discovered the symbiosis of *consocians* and *incerta* I had to confine my experiments to older queens.

The first experiment was made with an *incerta* colony consisting of three rather pale deälated queens, about a dozen workers, and quite a number of worker cocoons. This was part of a healthy colony that had not been infested with *consocians*. Aug. 19, two darker deälated *incerta* queens from another colony and a single *consocians* queen, found living with *incerta* workers (colony No. 5), were introduced into the same nest. The *consocians* queen passed out of the empty food-chamber, in which she had been placed, and forthwith joined the strange *incerta* as if she had merely returned to her own colony. She was received without the slightest animosity and soon set about licking the callow workers that were hatching from the cocoons. From time to time she begged the older workers for food and was generously fed. This colony has now been under observation for four weeks, but I have failed to see any signs of animosity between the *consocians* queen on the one hand, and the *incerta* queens and workers on the other. But the introduced *incerta* queens were recognized as aliens the moment they entered the nest and there were daily struggles between the three pale and the two dark queens and still more frequent battles between the *incerta* workers and the strange queens. The latter were dragged about the nest by the hour, tweaked, and sprayed with formic acid. One of them succumbed miserably Aug.



21; the other seemed to remain unmolested for several days, as if the workers had consented to adopt her, but she, too, died Aug. 31, possibly from the injuries sustained earlier in the month. At the date of this writing (Sept. 15) the *consocians* queen, the three pale *incerta* queens, and 22 workers are living together as a united and happy family.

A second experiment of a somewhat different character was begun Aug. 19 with a dozen *incerta* workers from an uninfested colony, a single *incerta* queen from another nest, and two *consocians* queens which may be called A and B. A was somewhat the smaller, and was taken from colony No. 15, which contained only *consocians* workers. B came from colony No. 14, which comprised workers of both species. The two *consocians* queens at once mounted the pile of *incerta* cocoons, begged the workers for food, and began licking the newly hatched callows. But they were promptly detected as aliens, pinioned by a leg or an antenna, and dragged about the nest. Whenever they could escape from the jaws of the *incerta* workers they ran back nimbly to the nursery, only to be again dragged away in a few moments. They offered no resistance and never attempted to attack either each other or an *incerta* worker or queen. They were, in fact, almost ludicrously humble and conciliatory, now vainly begging for food, now exhibiting the greatest interest in some newly hatched callow, and anon attending to their toilet, combing their hair and drawing their antennæ through their strigils. The strange *incerta* queen, however, was even more severely maltreated by the workers of her own species. They pulled her legs and antennæ by the hour and when this became monotonous they sprayed her with copious showers of formic acid. All of these insults she endured patiently for some days, but finally one afternoon I saw her turn in a fit of rage and punish one of her tormentors severely. For several days she seemed not to be molested, but her temper was thoroughly aroused. One day I saw her, without the slightest provocation, seize one of the *consocians* queens by the mandibles, then loosen her hold and slide her jaws back to the small queen's neck as if to cut off her head. The *consocians*, however,

slipped away. On the morning of Aug. 22 *consocians* B was found dead in the nest with an antenna extirpated. On the afternoon of the same day *consocians* A was also dispatched by a large *incerta* worker. This queen was the older of the two, since she floated in alcohol.<sup>1</sup> The *incerta* queen seemed to have made peace with the workers. Hereupon I introduced a *consocians* queen (from colony No. 7) that had been living with a few *incerta* workers only. This insect was very amicably received by the colony that had executed queens A and B. After a period of apparent adoption the *incerta* queen was found dying Sept. 4, and the next day was completely dismembered by the workers of her own species. At the present writing (Sept. 15) callows are still hatching from the *incerta* cocoons, and the colony with its single *consocians* queen is in a peaceful and flourishing condition.

Aug. 25, I introduced a female *consocians* that had been living with a few *incerta* workers (of colony No. 4) into an artificial nest containing a portion of a large pure colony of *consocians*. On entering the chamber the queen showed the greatest alarm. While she was running wildly to and fro she was repeatedly seized by different workers of her own species, so severely bitten and so thoroughly drenched with formic acid that I had to remove her from the nest in order to save her life.

These rather fragmentary experiments point to the following conclusions:

(1). A *consocians* queen that has been living with *incerta* workers is readily adopted by strange *incerta* colonies.

(2). A *consocians* queen is not adopted by *incerta* workers if she has been living previously with workers of her own species, unless, perhaps, she is a very young queen that has just left the parental nest.

(3). A *consocians* queen that has been living with *incerta* workers is violently attacked by a vigorous colony of her own species.

(4). Colonies of *incerta* are far less hospitable to *incerta*

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<sup>1</sup> In aged dealated queens the wing-muscles degenerate and air takes their place in the thoracic cavity, so that such specimens float in water or alcohol.

queens from strange colonies than to *consocians* queens that have been living with strange *incerta* workers.

These conclusions were perhaps to be expected from what is known concerning the rôle of the nest and colony odors among ants. The last conclusion is the most significant in the absence of any experiments on young *consocians* queens that have just descended from their nuptial flight.

There still remain certain interesting questions which are only incompletely or vaguely answered by the above observations and experiments. First, why are all the natural *consocians-incerta* colonies without a queen of the latter species? Does the *consocians* queen normally seek out only small, either incipient or depauperate *incerta* colonies that have through some misfortune lost their queen or queens? Or if present when the *consocians* is adopted, how is the *incerta* queen disposed of? Is she killed by the parasitic queen or by her own workers in a fit of instinct perversion? That the *consocians* may, at least occasionally, seek adoption in *incerta* nests that have not lost their queens, is shown by the observation on colony No. 1, and the experiments on artificial nests point to amicable adoption by *incerta* colonies still in possession of their queens. The contrary, however, seems to be indicated by the offensive behavior of the *incerta* workers in colony No. 1 and by the fact that many of the colonies in which I found *consocians* queens were obviously depauperate. Some of these colonies comprised only a few small workers and must have been incipient, whereas others, as indicated by the contrast between the extensive excavations of the nest and the very small number of large workers were clearly decadent or moribund. Moreover, during my search for infested *incerta* colonies, I saw not a few pure colonies of this species without queens and apparently favorable to infection by *consocians* queens.

A second question is also suggested: How do the *consocians* eventually emancipate themselves from the *incerta* colony? Do the *consocians* destroy the remaining *incerta* workers? Or are the latter permitted to die off naturally and thereby depauperate the colony? Or do the *consocians* simply move away

and establish a nest of their own apart from the *incerta* workers? The first supposition is unantlike, and therefore improbable. The second would seem to be indicated by such colonies as No. 12, which contained very few *incerta* living with many *consocians*. Colony No. 14 shows that the *consocians* are rather easily induced to move away from their nest, and I have observed this also in the case of much larger colonies. Some of the facts recorded on other ants (see p. 363 *infra*) seem also to indicate that the *consocians* colony may purify itself by migration.

It must now be shown why the *incerta-consocians* association may be termed a new type of social parasitism or symbiosis. With certain important exceptions, to be considered presently, the mixed colonies hitherto described group themselves naturally about three species: *Formica sanguinea*, *Polyergus rufescens*, and *Anergates atratulus*. In other words, these three European ants serve as types of as many forms of symbiosis. *F. sanguinea* and *P. rufescens* represent two apparently successive phylogenetic stages in the development of dulosis, or of the slave-making instinct. Wasmann<sup>1</sup> designates the former as facultative, the latter as obligatory in this respect. *Anergates* is the type of a small group of parasitic ants that have secondarily lost the worker caste. To this group probably belong also the American *Epæcus pergandei*, *Epipheidole inquilina*, and *Sympheidole elecebra*.<sup>2</sup> All of these cases of symbiosis, however, agree in being *permanent* consociations of two species.<sup>3</sup> The case of the *consocians-incerta* colonies is clearly different in that the former species is parasitic only during the incipient stages of colony formation. It may therefore be designated as a *temporary* social parasite, a true cuckoo ant, which sponges on another species only so long as necessary in order to gain a successful start in life. In the classification which I have given of the compound nests and mixed colonies, it would constitute the type of a temporary,

<sup>1</sup> Neues über die zusammengesetzten Nester und gemischten Kolonien der Ameisen. Allgem. Zeitschr. f. Entomol., Bd. 6, 1901.

<sup>2</sup> See my paper: Three New Genera of Inquiline Ants from Utah and Colorado. Bull. Am. Mus. Nat. Hist., Vol. 20, Art. 1, pp. 1-17, pl. 1 and 2. Jan. 14, 1904.

<sup>3</sup> With the possible exception of certain old and populous colonies of *F. sanguinea*, which seem to lose the power of or inclination for keeping slaves and may thus become pure colonies.

as distinguished from the stable, or permanent colacobiosis of *Anergates*.<sup>1</sup> It furnishes an interesting analogy to forms of individual parasitism such as we see in many insects that are parasitic in their larval but free-living in their adult stages.

Let us return for a moment to the particular case of the *consocians-incerta* colony, for the sake of asking a question which must have occurred to the reader of the preceding pages: Why is the incipient colony of *consocians* parasitic on the colony of another species of *Formica*? The obvious answer to this question is that the *consocians* female is unable to establish her colony without the assistance of mature workers. It is now well known that the queen ant of most species, after enclosing herself in a small chamber in the soil or in dead wood, proceeds to raise her first batch of workers entirely by herself, feeding them with her salivary secretions, which are in turn derived by metabolism from her fat-body and no longer functional wing-muscles. Weeks or even months elapse before the workers mature and go forth into the world to obtain food for themselves and their queen. This undoubtedly involves a great strain on the endurance of the mother insect, and many undoubtedly succumb without ever being able to establish a colony. For the queen of *consocians*, which barely exceeds the largest workers in size, it is probably quite impossible to bring up even a batch of very small workers, and recourse must be had to parasitism. Indeed, the diminutive and feeble organization of the queen *consocians* implies relative infertility and a very limited range of dissemination of the species during the nuptial flight. This is also borne out by observation. In all the mixed colonies offspring of the *consocians* queens were either completely lacking

<sup>1</sup> From κόλαξ, a flatterer; κολακίς, a female flatterer. Without, at the present time, entering into an elaborate defence of my classification of the various cases of social symbiosis, I may say that Wasmann's veiled disapproval of the Greek terminology introduced by Silvestri for termites and by myself for the ants, appears in a strange light when we see him, in the same breath, as it were, introducing such terms as *phylacobiostis* and *echitrobiostis*. I really care very little for the Greek terminology or scholastic definitions of my categories, which a less captious critic would have understood to mean naturally separable groups in the same sense as we regard the genera of the animal kingdom as coördinated categories, though it is well known that a genus of birds or mammals is logically more nearly the equivalent of a species in insects. Wasmann fails to see the impracticability of imposing a rigidly conceptual scheme on a body of intergrading phenomena like those comprised under social symbiosis, phenomena which are, moreover, very inadequately known. I shall return to this subject when I come to publish my observations on the American *sanguinea* and *Polyergus*.

or very few and in late stages of development, and during a month's captivity none of the queens in six nests have shown any disposition to lay eggs notwithstanding the fact that the insects have been well fed. The circumscribed range of dissemination during the nuptial flight is indicated by the sporadic or local occurrence of these ants. The production of such small queens cannot, however, be altogether disadvantageous. On the contrary, it is probably much easier for the adult *consocians* colony to produce these diminutive individuals than for colonies of *F. fusca* and *pallide-fulva* and their varieties to produce their much larger queens. We should even expect to find the number of queens produced by a large *consocians* colony greatly in excess of the number produced by *fusca*, *cinerea*, etc., colonies of the same size, for the same reason that the eggs of many parasitic worms (*Tænia*, *Distoma*, *Ascaris*, etc.) are much more numerous, though individually smaller, than in many non-parasitic species. The lateness of the season prevented me from investigating this interesting matter, but an observation recorded in the next paragraph would seem to indicate that the *consocians* colony sends off a great number of winged females. This, together with the fact that old *consocians* colonies contain an enormous number of workers, seems to imply that the old queens of this species must differ greatly from the young ones in being extremely fertile or that the large workers must be capable of producing both worker and female offspring.

The views advanced in the preceding paragraph gain in probability when we come to consider certain other North American ants that are very exceptional in their respective genera in having diminutive females. The most striking of these is *F. microgyna* which I have described from Colorado.<sup>1</sup> The adult colonies and nests of this ant are very similar to those of *F. consocians*. Winged females are produced in great numbers, as I find on consulting my Colorado note-book, in which I mention "many dozen females" as occurring in a single colony. On looking over my extensive collections of ants from the vicinity of Pike's Peak, I find the specimens and

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<sup>1</sup> Extraordinary Females, etc., p. 645 *et seq.*

a record of three small mixed colonies of workers belonging to *F. microgyna* var. *rasilis* and *F. fusca* var. *argentata*. Two of these were taken in South Cheyenne Cañon at an altitude of about 8000 feet and at Broadmoor, the third at an altitude of 11,500 feet on Pike's Peak. In all of these colonies the *rasilis* workers were of small size and infuscated. I infer from these cases that *F. microgyna* is, in all probability, a temporary parasite like *F. consocians*.

In a lot of material collected in Nevada and Colorado, I have recently discovered two additional ants with diminutive females. Like *difficilis* and *microgyna* they are mountain-inhabiting forms belonging to the *rufa* group. They are described in Appendix C as *F. microgyna* var. *nevadensis* and *F. montigena*. Of the former I have seen only a single winged female, which differs from the same sex of the typical *microgyna* in being more pilose and in having a more shining gaster. Of the latter, which is allied to *F. dakotensis*, I have seen all three phases. It occurs on the higher slopes of the mountains about Ute Pass, in Cheyenne Cañon, and on Pike's Peak. In the first mentioned locality I saw several huge colonies, one of which consisted of four nests a few yards apart under pine logs banked with vegetable débris. Each of these nests was exceedingly populous, but seemed to contain only workers and worker pupæ, the latter nearly all naked. The insects attacked me with great fury. Among the colonies seen on Pike's Peak and in Cheyenne Cañon, two were mixed with *F. incerta*. Both were small and evidently incipient. The Pike's Peak colony was found under a stone and comprised about 50 mostly callow *montigena* workers and 7 or 8 *incerta* workers. There were a few worker pupæ of the former species. The other colony, which was also under a stone, comprised hardly more than a dozen small *montigena* workers and only five or six *incerta* workers. In neither nest did I find a queen of either species. I feel confident, however, that there were no *incerta* queens, and as it would be even easier to overlook a dealated *montigena* than a *consocians* queen, especially when one is not prepared to find so small and worker-like an insect, I lay no stress on this negative observation.

The two mixed colonies lead me irresistibly to the conclusion that *montigena*, like the preceding species, is a temporary parasite in the nests of another ant. In this case the host is the same as that of *consocians*, namely *F. incerta*, which seems to be quite as abundant in the Rocky Mountains as it is in the hills of New England.

In my paper cited above,<sup>1</sup> I called attention to the fact that there is still another American ant of a very different subfamily, namely the Myrmicine *Stenamma* (*Aphenogaster*) *tennesseense*, the queens of which are quite unlike the females of any other species of the genus in being very small and glabrous. Now in my paper on the compound nests and mixed colonies I published an observation of the late Rev. P. J. Schmitt, O. S. B., who found a mixed colony of *S. tennesseense* and *S. (A.) fulvum aquia* var. *piceum*. The queen of the colony belonged to the former species. Rev. Schmitt was impressed by the fact that the nest was under a stone, whereas *tennesseense* normally occurs only in dead wood at Beatty, Pennsylvania. This seems to be generally true of the species. In Illinois and Wisconsin I have never taken it except in the old logs in rather open forests. Since these observations were published I have myself found two mixed colonies of the same kind near Rockford, Illinois. The following is taken from my note-book under date Aug. 9, 1902:

"Found under a stone below the railroad embankment at the edge of a wood a mixed colony of *S. tennesseense* and *S. fulvum* var. *rude*. It was of small size and contained about two thirds as many *tennesseense* as *rude* workers. The former were mostly callows as shown by their light color. There were also some larvæ and several unmistakable *tennesseense* pupæ. On digging deeply into the earth a deälated *tennesseense* queen was found, but no female of *rude*. A large portion of this colony was taken home in a bag and placed in a Forel's arena surrounding an open Fielde nest. While moving into the nest the *S. rude* workers always carried the *tennesseense*.

"About a quarter of a mile from the locality in which I found this nest, I came upon another of a very similar char-

<sup>1</sup> Extraordinary Females, etc., p. 650.



acter. It, too, was under a stone, but contained more *tennesseense* than *rude* as nearly as I could ascertain. In this case also many of the former were callows. There were quite a number of larvæ, presumably belonging to *tennesseense*. No queen of either species was found."

In the light of the preceding observations on *Formica* species with diminutive queens, it seems very probable that the *S. tennesseense* queen must be similarly unable to bring up her own brood and therefore compelled to seek the assistance of an incipient or depauperate colony of some variety of *S. fulvum*. The fact that the *tennesseense* colony is first established under stones, but when populous is always found in rotten wood, indicates that it may depurate itself by migrating away from the *fulvum* workers. As bearing on the question considered on p. 360 *ante*, it should also be noted that the number of females produced by a single populous *tennesseense* colony is considerably in excess of the number produced by large colonies of our other species of *Stenamma* (including the subgenera *Aphænogaster*, *Ischnomyrmex* and *Messor*). Moreover, so far as my observations go, *S. tennesseense* is sporadic in its occurrence, and is found only in regions where *S. fulvum* or some of its varieties are unusually abundant.

Since all the foregoing species are alike in having diminutive females, we are naturally led to inquire whether temporary colacobiosis is peculiar to such species. This question must, I believe, be answered in the negative. In *Formica exsectoides*, the famous "mound-making ant of the Alleghanies," so familiar to the rural population of the Atlantic States from Massachusetts to North Carolina, we have an ant that agrees with most species of its genus in possessing large queens. Nevertheless an interesting series of observations can be adduced to show that this species is in all probability a humble temporary parasite. These observations, cited in my former paper, may be repeated here: "Forel found a small mixed formicary of these species [*F. exsectoides* and *F. subsericea*] at Hartford, Conn. Rev. P. J. Schmitt writes me that he has found at different times five different nests of *F. exsectoides* - *subsericea*. These invariably contained

females of the *exsectoides* only. All these colonies were, moreover, obviously incipient, as shown by the fact that they contained scarcely more than fifty ants, including both species." I have myself found two similar colonies at Colebrook, Conn. One of these is mentioned in a foot-note at p. 800 of my paper on compound nests, etc. In all, therefore, eight cases of small or incipient *exsectoides-subsericea* colonies have been found. This number is quite sufficient to suggest the temporarily parasitic nature of *exsectoides*, notwithstanding the much greater size of its queens.

At this point I feel tempted to leave the field of my own observations in order briefly to discuss certain mixed colonies observed by other myrmecologists. In my paper on the compound nests, etc., I combined a number of cases like those of *Stenamma tennesseense-fulvum* and *F. exsectoides-subsericea* in a single avowedly dubious category (synclerobiosis<sup>1</sup>). To this I also assigned a number of cases observed by European authors and designated by Wasmann as accidental or abnormal mixed colonies. To-day I am willing to assign nearly all of these cases to temporary colacobiosis, or social parasitism, but that I was nearer the truth in embracing them in a single category than Wasmann in calling them accidental or abnormal and distributing them among his other categories, will be seen from the following paragraphs, in which I shall attempt to show that these various mixed colonies, at least in so far as they relate to ants of the *F. rufa* and *exsecta* groups, belong, in all probability, to the same type as *F. consocians* and *F. exsectoides*.

Among the species studied by other authors, *F. dakotensis* var. *wasmanni* must first be considered. This ant was originally observed by Rev. H. Muckermann, S. J., in the vicinity of Prairie du Chien, Wis. His notes were published by Wasmann<sup>2</sup> as referring to the typical *dakotensis*, but Forel has since shown that the Wisconsin form is to be regarded as a distinct variety.<sup>3</sup> Muckermann found in all some nine colo-

<sup>1</sup> From συγκληρώ, to embrace in one lot.

<sup>2</sup> Neues über die zusammengesetzten Nester, etc., pp. 6-11.

<sup>3</sup> Fourmis de British Columbia récoltées par M. Éd. Whymper. Ann. Soc. Ent. Belg., Tome 48, 1904, p. 153.

nies of this interesting ant, and five of these were mixed with *F. subsericea*; the four presumably much larger colonies, comprising altogether some twenty nests, were pure *wasmanni*. In the mixed colonies the ratio of the *wasmanni* to the *subsericea* workers was 7:3 or 7:4. When the ants moved to a new nest the workers carried only workers of their own species. In the mixed colonies Muckermann could find no females of *subsericea*, but only those of *wasmanni*. On one occasion, however, he came upon two deãlated *wasmanni* queens and some callow workers of the same species living together with a deãlated *subsericea* queen and workers under the same stone. From these facts, which constitute the substance of Muckermann's observations, Wasmann concludes that *F. wasmanni* is a facultatively dulotic ant, possessing a somewhat feebler slave-making instinct than *F. sanguinea*. This conclusion is, in my opinion, premature. Muckermann saw no slave-making expeditions on the part of the *wasmanni* and these would have to be witnessed before it could be regarded as a dulotic species. Moreover, as Wasmann himself admits, the small colony above referred to, embracing both *wasmanni* and *subsericea* queens, strongly indicates consociation by adoption rather than by dulosis. The fact that *wasmanni* is a pugnacious ant is no indication whatever of dulosis, as shown by cases like *F. consocians* and *montigena*. Thus there is really nothing in the facts observed by Muckermann that would prevent us from including *wasmanni* with the cases of temporary social parasitism, especially as this species seems to be rather closely related to *F. montigena*. Of course, this view must be tested by further investigations.

It will now be necessary to enter on the more delicate task of interpreting certain mixed colonies that have been observed in Europe. These consist of *F. fusca* as one component and ants of the *exsecta* or *rufa* groups as the other. In the "Fourmis de la Suisse" (pp. 371-373) Forel describes six colonies of this description: two of *exsecta-fusca*, two of *exsectopressilabris-fusca*, one of *truncicola-fusca*, and one of *pratensis-fusca*. With the exception of one of the *exsecta-fusca* colonies, all of these were small and incipient. The

perusal of Forel's notes shows that they closely resembled the American *consocians-incerta* and *exsectoides-subsericea* colonies. Wasmann<sup>1</sup> mentions another similar incipient colony of *pratensis-fusca*, and more recently<sup>2</sup> he has described two mixed colonies of *truncicola-fusca*. Each of these consisted of a number of *fusca* workers and a single deälated *truncicola* queen. The similarity of these to such colonies as Nos. 2-7 of *consocians-incerta* is very suggestive.

In addition to these relatively simple cases, Forel and Wasmann have each described mixed colonies made up of three different species. Two of these colonies described by Wasmann consisted of *sanguinea-fusca-pratensis* and *sanguinea-fusca-rufa* respectively. He gives good reasons for supposing that in the former case a *pratensis* queen had been adopted by a queenless *sanguinea-fusca* colony. In all probability the latter case is to be explained in the same way. He also made the interesting observation that the *sanguinea-fusca* finally migrated away from the *pratensis*. Forel<sup>3</sup> has recently described a remarkable mixed colony consisting of *Polyergus rufescens*-*F. fusca*-*F. pratensis*. It contained five or six deälated queens of *pratensis*, but no *Polyergus* queen.

Both Forel and Wasmann interpret these colonies, of, which some form of *exsecta* or *rufa* is a component, as colonies formed by adoption. In other words, we must suppose the female of the *exsecta* or *rufa* form to enter a simple *fusca* colony or one that happens to be living with *sanguinea* in a state of dulosis, for the purpose of establishing her own family. The cases are sufficiently numerous to show that there is probably as strong a tendency towards social parasitism on the part of the European *rufa* and *exsecta* as there is in the American members of these groups of *Formica* (*montigena*, *microgyna*, *exsectoides*, etc.). Indeed, I believe we may go even further and maintain that, when more attention has been devoted to a study of their incipient colonies, the Euro-

<sup>1</sup> Die zusammengesetzten Nester und gemischten Kolonien der Ameisen, Münster i. W., 1891, pp. 173, 174.

<sup>2</sup> Neues über die zusammengesetzten Nester, etc., pp. 20, 21, 77.

<sup>3</sup> Fourmilière Triple. Bull. Soc. Ent. Suisse, 10, pp. 280-282.

pean *rufa* and *exsecta* will be found to be normal temporary social parasites in the colonies of *fusca*.

If I have not unduly expanded the conclusions derived from my study of the *consocians-incerta* colonies, it follows that nearly all the mixed colonies which Wasmann calls abnormal or accidental are, on the contrary, quite normal and regular cases of temporary social parasitism.<sup>1</sup> If, however, it should be shown that the European *rufa* and *exsecta* queens are perfectly able to start their own colonies, the tendency to parasitism would still be indicated by the above cases and these would be of considerable interest as representing an imperfect phylogenetic stage that has led to the perfected parasitic instincts of *F. consocians*. That this insect has become completely adapted to temporary parasitism is shown by the mimetic characters of its queen, so closely resembling the *incerta* workers in size and gait and, to a considerable extent also, in coloration.

The question will certainly be asked at this point: Are we to believe that that magnificent mound-builder among our northern ants, the fallow ant (*Formica rufa*), with its many subspecies and varieties, and the fierce *F. exsectoides*, which is said to form single colonies of as many as 1800 large mounds,<sup>2</sup> all begin their colonies as parasites in the insignificant nests of humble congeners like *F. fusca*, *F. schaufussi*, and their varieties? This does in fact seem like a preposterous supposition. But we may ask in turn: Has anybody in Europe or America ever found a solitary queen of the *rufa* or *exsecta* groups establishing her colony? I have collected assiduously

<sup>1</sup> I am far from denying the existence of what Wasmann calls 'abnormal' or 'accidental' mixed colonies. I can, in fact, cite a number of such cases from my own observation. But I should prefer to designate these as mixed colonies of uncertain meaning and retain them in my provisional category *synclerobiosis*, since it is better frankly to admit our doubts than to clothe them in words like 'accidental' and 'abnormal' and attempt to distribute these cases among the better known categories of mixed colonies. Miss Fielde (Artificial Mixed Nests of Ants. Biol. Bull., Vol. 5, No. 6, Nov., 1903) has shown that there is probably a general law underlying the formation of artificial mixed colonies, and there is no reason to suppose that this does not obtain also in a state of nature. That Miss Fielde could make artificial mixed colonies from species belonging to different sub-families, whereas such colonies do not occur under natural conditions, may be explained by the fact that she worked with comparatively few individuals. I cannot but think that larger colonies of any one of these species would present a greater number of hostile variations among its component workers and union between representatives of different subfamilies be thereby rendered impossible. Even in a state of nature *synclerobiotic* colonies of species belonging to the same taxonomic subfamily are small and feeble.

<sup>2</sup> See McCook: Mound-making Ants of the Alleghanies. Trans. Am. Ent. Soc., Vol. 6, 1877, p. 254.

during the most favorable seasons in regions like Colorado, which surpasses all other regions of the globe in the great wealth of its *Formica* fauna, without finding a single queen of the *rufa* group in the act of starting a colony, though I have often seen queens of the *fusca* and *pallide-fulva* groups thus engaged. And although *rufa* is a very well known and widely distributed ant in Europe, I have found in the works of European myrmecologists no account of the establishment of its magnificent colonies. This is, of course, purely negative evidence, and perhaps its only value in this connection, like the preceding discussion of the mixed colonies of uncertain meaning, may be to direct attention to the insufficiency of our knowledge and the desirability of making further researches.

That such vast colonies as those of *F. rufa* and *exsectoides* should have a parasitic origin—should, in fact, be a splendid example of the *ex humili potens*—need not surprise us when we stop to consider that the history of the paragon of animals is replete with even more extraordinary developments of might and insolence from insignificant and squalid parasitism. We may compare—*si parva licet componere magnis*—the timorous and conciliatory *consocians* queen and her tiny colony of workers which will eventually give place to the pugnacious and self-assertive adult colony, with the humble and inquilinous origin of certain historical families, political parties, and religious sects, and their insolent and aggressive attitude as soon as their numbers have sufficiently increased.

In conclusion I will endeavor to answer a question that has been asked by Wasmann in connection with the mixed colonies of dulotic ants: namely, Why does not social parasitism like that of *F. consocians* ultimately lead to the extinction of the host species? Including both the cases of dulosis and social parasitism in the answer, we may say that the host species do not become extinct, because

1. They are dominant, that is, very fertile and prolific species, abundantly represented by individuals over a wide stretch of territory. Only such ants would naturally be

selected by the parasite, since they are both the most opportune and favorable of hosts.

2. The parasitic species are local or sporadic, or, in any event, more restricted in their distribution than the host species. This may be due to deficient fertility or to greater dependence on a precise physical and biological environment, or to both of these factors.

3. Even within what may be called the area of infection of the host species by the parasitic ants, the former is able to maintain a foothold or even to increase in numbers on account of a certain margin of redundant vitality, which is commonly not completely exhausted by the inroads of the parasite.

4. These various conditions may enable a host to support parasites of several different species in the same or different portions of its range, especially if, in turn, the parasites are not necessarily restricted to a single species of host ant. This is clearly seen in *F. incerta*, which is preyed upon by at least three other insects in addition to *F. consocians*: the little thief-ant (*Solenopsis molesta*) and two Staphylinid beetles, *Xenodusa cava* and *Hesperobium flavicorne*. During the past summer I found several colonies of *incerta* containing numerous pseudogynes, which must have been produced by the presence of the beetle parasites, if Wasmann's theories may be expanded to embrace American ants. In a forthcoming paper I shall consider this subject in detail.

#### APPENDIX A.

Examination of large series of workers, males and females of two new varieties and of all the described forms of *F. pallide-fulva* from numerous localities, convinces me that Emery's table for the identification of the workers of this species should be modified to read somewhat as follows:

- (1.) Maxillary palpi, especially their two last joints, conspicuously long; lower surface of head and edge of petiole depilate.  
(a.) Color pale yellow, gaster slightly infuscated or sordid,  
*pallide-fulva* Latreille s. str.  
(b.) Color throughout reddish yellow. . . var. *succinea* var. nov.

## (2.) Maxillary palpi shorter.

(a.) Edge of petiole and lower surface of head more or less pilose; large forms.

(α.) Reddish yellow, with more or less infuscated gaster; pubescence and hairs long and abundant, subsp. *schaufussi* Mayr.

(β.) Reddish yellow throughout; hairs and pubescence longer than in the preceding form, especially on the gaster where the pubescence is very close and conceals the shining surface,

var. *meridionalis* var. nov.(γ.) Color variable, sometimes like the typical *schaufussi*, sometimes like *nitidiventris* (*vide infra*); hairs on petiole and lower surface of head fewer and less constant than in *schaufussi* and *meridionalis*. . . . . var. *incerta* Emery

(b.) Edge of petiole and lower surface of head depilate; smaller forms.

(α.) Reddish yellow, with black gaster; pubescence on the latter short and sparse so that the shining ground surface is clearly revealed,

subsp. *nitidiventris* Emery.(β.) Head and thorax deeply infuscated, nearly or quite as dark as the gaster; surface of body usually more opaque than in *nitidiventris*,var. *fuscata* Emery.

The new variety *succinea* occurs in Texas, where I have taken it in the sandy or pebbly soil of the post-oak woods at Austin, Montopolis, and Milano, and among the limestone hills about Bee Creek, Travis County. It rarely nests under stones but constructs mounds two to four inches in diameter, with a central opening  $\frac{1}{2}$ – $\frac{3}{4}$  inches in diameter, made of coarse sand or small pebbles. These nests resemble those of *Myrmecocystus* in Colorado, Western Texas, and Mexico. I took the beautiful yellow males and winged females May 26.

The new variety *meridionalis* was found inhabiting obscure mounds in grassy soil in the cañons about Bull Creek, west of Austin, Texas. There are in my collection also three workers taken by the late Rev. P. J. Schmitt, O. S. B., in North Carolina.

Emery regards *fuscata* as a subspecies, but it seems to me to be hardly more than a variety. Color and pilosity are often



very variable even in workers of the same colony. Transitional forms occur between *schaufussi* (typical) on the one hand, and *meridionalis* and *incerta* on the other, between *incerta* and *nitidiventris*, and between *nitidiventris* and *fuscata*; so that it might be permissible to reduce even *nitidiventris* to varietal rank.

*F. pallide-fulva* and all its subspecies and varieties appear to be absent from the states of the Pacific Coast.

#### APPENDIX B.

##### *Formica difficilis* Emery var. *consocians* var. nov.

*Worker.* Length, 4-6 mm.

With the habitus of a small *F. rufa*. Mandibles 8-toothed. Clypeus rounded in front, not produced, carinate its entire length and with uneven surface. Maxillary palpi rather long. Head, excluding the mandibles, somewhat longer than broad even in the largest workers. Cheeks long, subparallel; occipital border not excised. Antennæ as in *F. rufa* and its various forms. Mesoëpinal constriction very distinct, epinotum rounded in profile. Petiole narrow and thick, with a rather sharp edge, both its anterior and posterior surfaces distinctly convex. Seen from behind the edge is transverse in the middle and obliquely truncated on either side. Gaster and legs as usual.

Body subopaque and finely but distinctly shagreened; frontal area, clypeus, and mandibles somewhat shining, the last finely striated.

Entire insect covered with microscopic, grayish pubescence, which is most distinct on the gaster, though barely dense enough to conceal the smooth dark brown surface. Hairs sparse, obtuse, suberect, and pale yellow; most conspicuous on the mandibles, front and postocular regions, on the upper surface of the thorax, gaster, and edge of petiole. There are also prominent hairs on the lower surfaces of the head, coxæ, tibiæ, and on the middle and hind femora. Scapes of the antennæ depilate.

In large workers the head, thorax, petiole, nearly one third of the first gastric segment, and more or less of the venter and the tip of the gaster are deep yellowish red; remainder of gaster very dark brown. Mandibular teeth blackish, tips of antennal funiculi and sides of clypeus somewhat infuscated. In the small workers there is a more or less pronounced infuscation of the head, thorax, petiole, and appendages.

*Female.* Length: 5.5-6 mm.

Mandibles 8-toothed, clypeus and head resembling those of the worker; thorax distinctly narrower than the head. Petiole narrow

and thick at the base, its anterior and posterior borders convex, its edge blunt. Gaster small, legs rather long and slender.

Body subopaque, very finely shagreened, lustrous, head and lower and lateral surfaces of gaster more shining. Mandibles striato-punctate. Frontal area shining or subopaque.

Whole insect clothed with fine golden yellow pubescence, which is denser in some specimens than in others, especially on the gaster. Body and legs with rather long, suberect, obtuse, golden yellow hairs which are conspicuous on the femora, tibiae, head, thorax, edge of petiole, and upper surface of gaster. Antennal scapes depilate.

Rich reddish yellow; apical two thirds of antennal funiculi and posterior edges of gastric segments faintly infuscated. Borders of mandibles and alar insertions black. Wings lacking in all the specimens.

*Male.* Length: 5.5–6 mm.

Mandibles edentulous, or with very faint indications of teeth. Head very short, broadest through the eyes, cheeks short, somewhat concave, posterior corners broadly rounded. Thorax broader than the head, robust. Petiole thick, strongly convex in front, somewhat more flattened behind, its edge very blunt, transverse when seen from behind. Gaster and appendages of the usual shape.

Body subopaque, finely shagreened, especially on the upper surface of the thorax and gaster; mandibles and frontal area less, genitalia more, shining.

Pubescence gray, most abundant on the gaster, less abundant on the thorax, and very sparse on the head. Hairs whitish, suberect, distributed much as in the female but much shorter and less conspicuous. Eyes naked.

Body and antennae black; apical half of mandibles, palpi, legs, and genitalia pale yellow; fore coxae black, middle and hind coxae, fore femora, and palpi slightly infuscated. Wings rather deeply smoky; veins and stigma blackish.

Described from twelve females, three males, and numerous workers from several colonies.

Type locality: Colebrook, Litchfield County, Connecticut.

This variety differs from the typical *difficilis*, described by Emery from New Jersey and Virginia, mainly in pilosity, as I find by comparing the Colebrook specimens with a winged female from Virginia sent me by Prof. Forel and a long series of workers and one dealated female collected by Mr. W. Beutenmüller in North Carolina. I am unable to determine the exact status of New Jersey specimens, since the only two

workers from that state in my collection are much rubbed and somewhat broken. The following are the main differences between the typical *difficilis* and the new variety. The worker of the former is much less pilose. There are no erect hairs on the front and behind the eyes, and the hairs are far less abundant on all the other portions of the body, including the legs. The petiole is more distinctly produced upward in the middle and even large workers have a greater tendency to infuscation of the upper surfaces of the thorax, head, and petiole. The female, too, has a sharper, more produced petiole, and fewer hairs on the legs. Emery describes the male as having the "Mandibeln kräftig gezähnt," which is certainly not the case in the males of the Connecticut variety.

*F. difficilis* (with var. *consocians*) is undoubtedly very closely related to *F. microgyna* Wheeler (with var. *rasilis*) in the worker and male phases, but the female of the former species is very distinct in color and pilosity, in having a much blunter petiole and a more elongate thorax. When more is known of our western species of *Formica*, it may be necessary to reduce *microgyna* to the rank of a subspecies under *difficilis*. See Appendix C, which contains a description of another variety of *microgyna*.

#### APPENDIX C.

##### *Formica microgyna* Wheeler var. *nevadensis* var. nov.

*Female.* Length: 4.5 mm.

Differs from the female of the typical *microgyna* in the following characters: The erect silvery white hairs covering the body, legs, and antennal scapes are somewhat longer and more abundant, the pubescence, on the contrary, is much sparser, especially on the gaster, where it fails to conceal the surface, so that this region is very smooth and shining. The mesonotum is not spotted, but, together with the scutellum, paraptera, and metanotum uniformly dark brown and rather sharply marked off from the remaining paler portions of the thorax. Occiput slightly infuscated. Gaster very dark brown, anal region red. Wings grayish hyaline with brown veins and stigma.

Described from a single specimen taken by Mr. C. F. Baker in Ormsby County, Nevada, during July, 1903.

***Formica montigena* sp. nov.**

*Worker.* Length: 4-6 mm.

With the habitus of a small *F. rufa*. Mandibles 8-toothed. Palpi rather short. Clypeus carinate its entire length, rather convex, its anterior border nearly straight, not produced. Head, excluding the mandibles, about as broad as long, sides subparallel, posterior corners broadly rounded, occipital border slightly concave in large workers. Antennæ as in the forms of *rufo*. In profile the mesonotum is straight, but rises in front rather abruptly above the pronotum. Mesoepinotal constriction pronounced, epinotal declivity concave below, rounded above, where it passes into the flat basal surface. Petiole thick in profile and very blunt above, its anterior surface convex, its posterior somewhat more flattened; seen from behind it is narrow with a horizontal upper border that passes over rather angularly into the sides. The latter are straight and converge below, so that the whole petiole is spade-shaped. Gaster and legs as usual.

Head, thorax, and petiole rather opaque, frontal area, upper portion of clypeus, frontal groove, and a little of the region between the frontal carinæ, smooth and shining. Mandibles sharply and densely striated. Whole body finely but sharply shagreened. Gaster and legs shining, the former with the appearance of "watered" silk.

Hairs suberect, short, golden yellow, and sparse. They are scattered over the upper and lower surfaces of the head, thorax, coxæ, and along the edge of the petiole. On the legs they are few and confined almost exclusively to the flexor surfaces of the fore femora. On the thorax and gaster they are obtuse and much scattered, on the latter mostly confined to the basal and apical segments. On the second and third segments there are only one or two transverse rows of hairs. Pubescence very sparse but distinct, especially on the legs and gaster where it produces the "watered" silk effect in conjunction with the finely shagreened surface.

Head, thorax, and petiole red, mandibles and corners of clypeus darker; teeth of the former and the gaster, black. Antennal funiculi, palpi, coxæ, and legs dark brown or blackish. In the smallest workers there is a tendency to infuscation of the occiput and the upper surface of the thorax and petiole, or to a more general deepening of the red ground color, involving the whole head, thorax, petiole, and the antennal scapes.

*Female.* Length: 7 mm.

Mandibles and clypeus like those of the worker. Head robust, as broad as long, its sides straight, slightly converging in front, posterior angles rounded, posterior border slightly concave. Thorax distinctly narrower than the head. Petiole extremely thick and blunt, its upper border seen from behind somewhat concave in the middle. Gaster and legs of the usual shape. Wings as long as the whole body (7 mm.).

Body and legs very glabrous and shining. Mandibles coarsely striatopunctate. Clypeus delicately longitudinally striated in front. Antennæ subopaque.

Hairs suberect, sparse, yellowish, longest on the gaster, especially towards its tip, shorter on the head and thorax and confined to the flexor surfaces of the femora and tibiæ. Pubescence grayish, very sparse and inconspicuous except on the antennæ.

Rich yellowish red. Mandibles, corners of clypeus, tarsi, and antennal scapes darker. Mandibular teeth, funiculi, and gaster black. Scutellum, metanotum, a triangular anterior and two elongate parapsidal blotches on the mesonotum dark brown.

*Male.* Length: 6.5–7 mm.

Head very short, narrow in front, broad behind, posterior corners prominent and rounded; cheeks short, concave. Mandibles with 2 or 3 distinct basal teeth. Clypeus sharply carinate. Thorax broad and robust. Petiole thick and very blunt above, with a distinct median excision in its upper border. Gaster, legs, antennæ, and wings of the usual shape.

Body subopaque, the head and pronotum and especially the genitalia and the upper surface of the gaster more shining. The surfaces are rather coarsely shagreened and those of the head and thorax have a very finely punctate appearance.

Hairs and pubescence sordid yellow, sparse and inconspicuous, especially on the upper surface of the gaster. Eyes naked.

Black. Genitalia reddish yellow. Legs sordid yellow, the femora, especially the anterior pair, more or less infuscated. Wings whitish hyaline, with brown stigma and paler veins.

Described from four males, a single female, and a great many workers taken from several nests in the following localities: Ute, Ute Pass; North Cheyenne Cañon; Pike's Peak, just below timber line (11,500 ft.) and at the printing office (10,000 ft.). The single female and several workers were taken by Prof. T. D. A. Cockerell in the locality last mentioned, Sept. 17, 1903. For notes on the habits of this species, see p. 361 *ante*.

*F. montigena*, though obviously a member of the *rufa* group, is nevertheless a clearly marked species. In the peculiar sheen of the gaster of the worker it resembles *F. dakotensis* and *F. exsectoides*, and is not unlike the former species also in the shape of the petiole. It differs from *dakotensis* in pilosity and from *exsectoides* in the shape of the head, petiole, etc. But it is especially the peculiar diminutive and highly glabrous female that gives the species its most distinctive character.



Article XXXI. — THE GREAT CRETACEOUS FISH  
PORTHEUS MOLOSSUS COPE.

By HENRY FAIRFIELD OSBORN.

PLATE X.

The noble specimen, of which a preliminary description is here given, adds another to the many services which Mr. Charles H. Sternberg has rendered to vertebrate palæontology. It was secured by him in the year 1900, near Elkada, Logan County, Kansas. Originally the specimen had been probably entirely complete, but portions of the skeleton, especially the ribs and spines, were injured and partly removed by previous explorers.

The fish was purchased by the Museum in 1901, mounted, and partly restored under the direction of the writer and of Mr. Adam Hermann, with the able assistance of Mr. A. E. Anderson, who made a special study of the details of the skeleton. He is not, however responsible for the restoration.

*Measurements.*

Total length from tip of tail to a point directly above premaxillaries, 15 ft. 8 in. = 4775 mm.

Length of skull, tip of premaxillaries to posterior edge of operculum, 2 ft. 2 in. = 660 mm.

Spread of tail, 3 ft. 9 $\frac{3}{4}$  in. = 1.106 mm.

The principal new features brought out by this skeleton are the complete vertebral column and caudal fin, and the relations of the anterior ribs.

In the restoration of the skeleton reproduced in the photograph (Plate X), reference is made especially to the figures of Crook and Stewart and to the descriptions of Hay.

In the pen composition drawing reproduced herewith (Fig. 1) reference has been made to the admirable figures of the skull by Stewart and Crook.

The pelvic fins were loaned from the private collection of

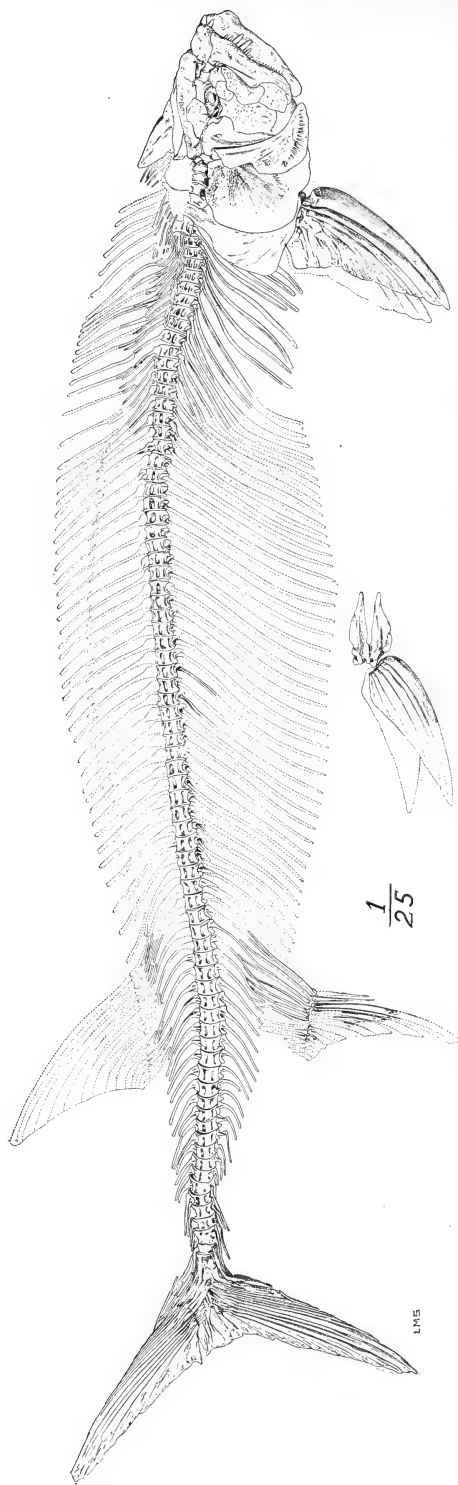


Fig. 1. Preliminary and partial restoration of *Porthetus molossus* Cope. The elements of the skull are partly restored after O. P. Hay and Alban Stewart.



Dr. O. P. Hay for the purpose of modelling and drawing, and are represented in detail in Fig. 4.

This specimen adds little to our knowledge of the skull.

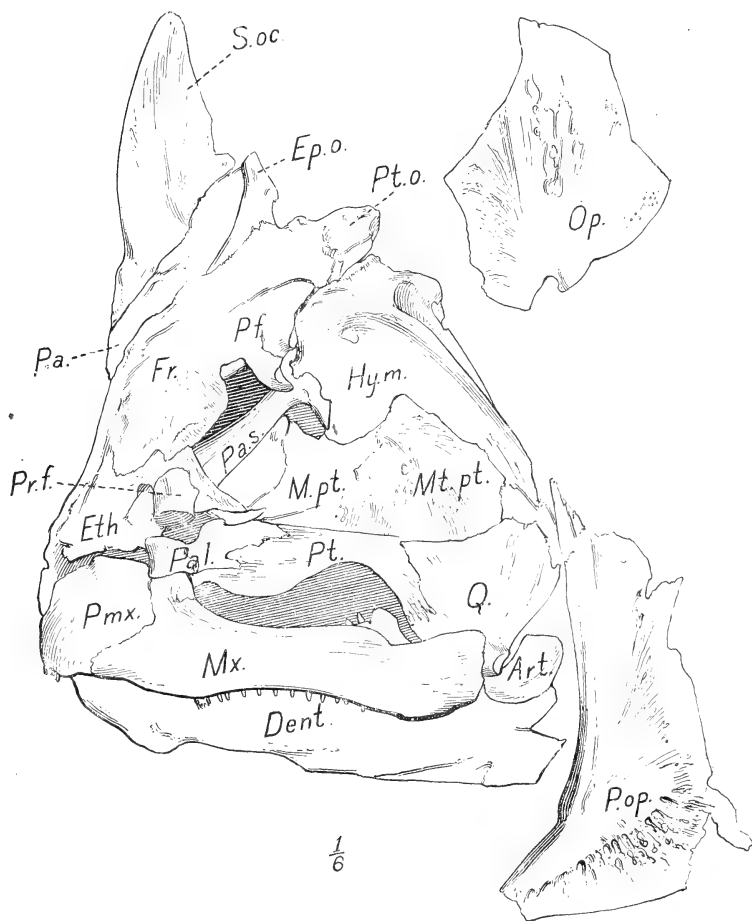


Fig. 2. Principal elements of the skull of *Portheus*, as revealed in a crushed specimen. (Amer. Mus. Coll.).

The total number of vertebræ is eighty-three. On the third vertebra (V. 3) the most anterior parapophysis and rib-articulation appear. The rib-bearing parapophyses become longer and more pointed as we pass back from V. 3 to V. 52.

V. 52 is the last vertebra in which there is a distinct rib-articulation on the centrum. V. 53 and V. 54 apparently

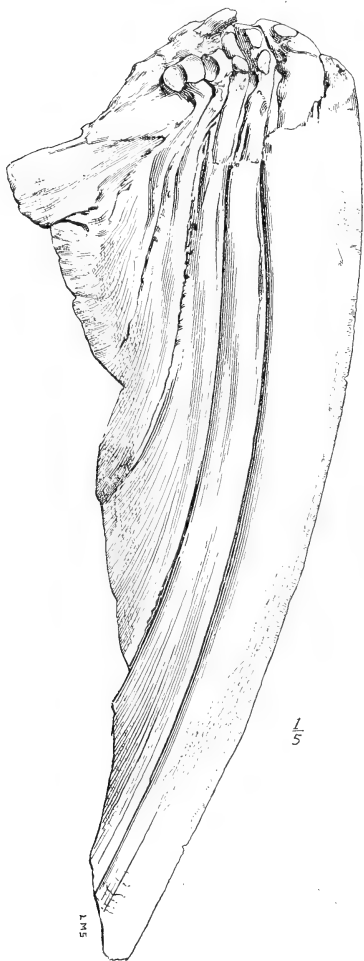


Fig. 3. Right pectoral fin of the *Porthoeus molossus* figured on Plate X.

bore the most anterior hæmapophyses. It is also possible that these processes represent elongated parapophyses behind which two ribs were fastened, as in the Tarpon.

The anterior interhæmal of the anal fin appears to lie between the hæmal spines of V. 55 and V. 56.

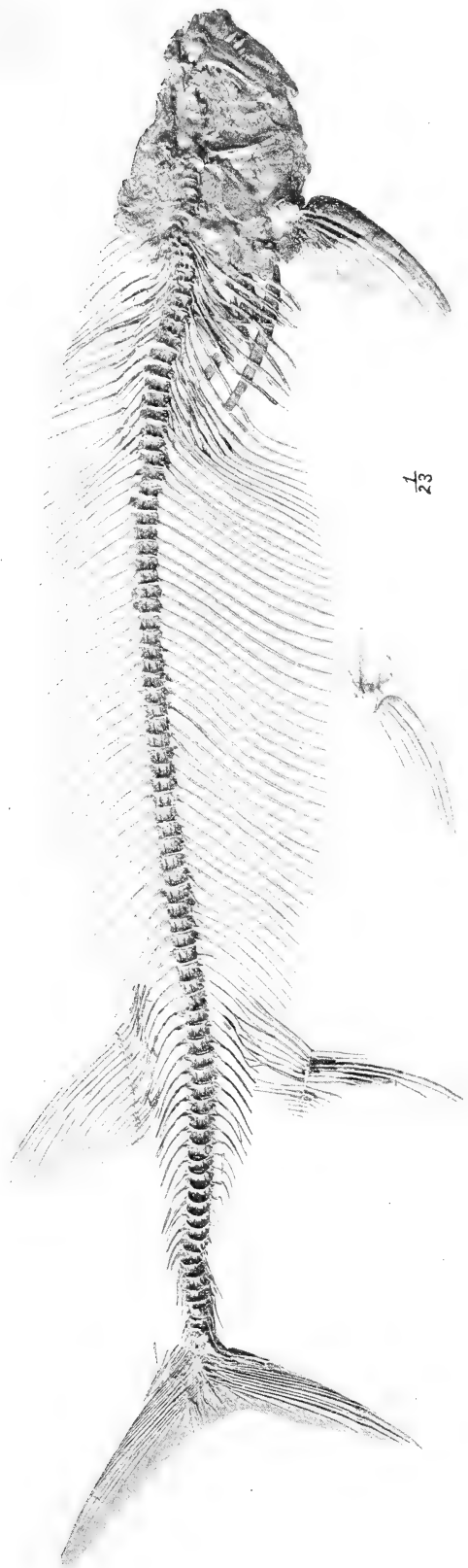
In the caudal region V. 80 and V. 81 are consolidated. V. 83 passes into the tail.

The right pectoral fin shows a very broad anterior ray, three distinctly defined intermediate rays, and two or more succeeding rays not so clearly defined.

The pelvic fins (Fig. 4) similarly show a broad anterior ray, three or four well-defined intermediate rays, and two or three succeeding rays. The dorsal aspect of the pelvic girdle is exhibited in the restoration.

The anal fin is attached at a point below ten vertebræ, namely, V. 55-65, by ten interhæmal rays, below which ten more or less complete anal fin rays are preserved.

The beautifully preserved caudal fin exhibits fifteen dorsal rays, four short intermediate rays which fringe out rapidly, and fifteen to sixteen ventral rays. It is thus remarkably symmetrical.



MOUNTED SPECIMEN OF *PORTHENUS MOLOSSUS* COPE. THE LIGHTER PORTIONS ARE RESTORED.

The position of the dorsal, pelvic, and anal fins, and the form of the dorsal and anal fins, are conjectural.



The position of the dorsal fin immediately above the anal fin is indicated by the presence of portions of eight interneurals which lie above vertebræ 56-63; these interneurals appear to connect with the partly cleft neural spines. This, however, is not conclusive evidence of the presence of the dorsal fin at this point.

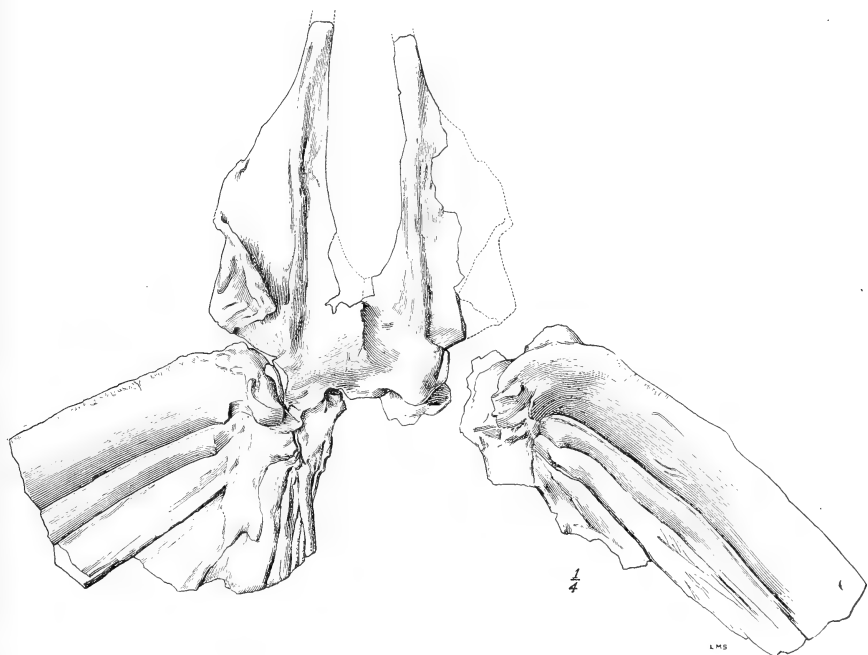
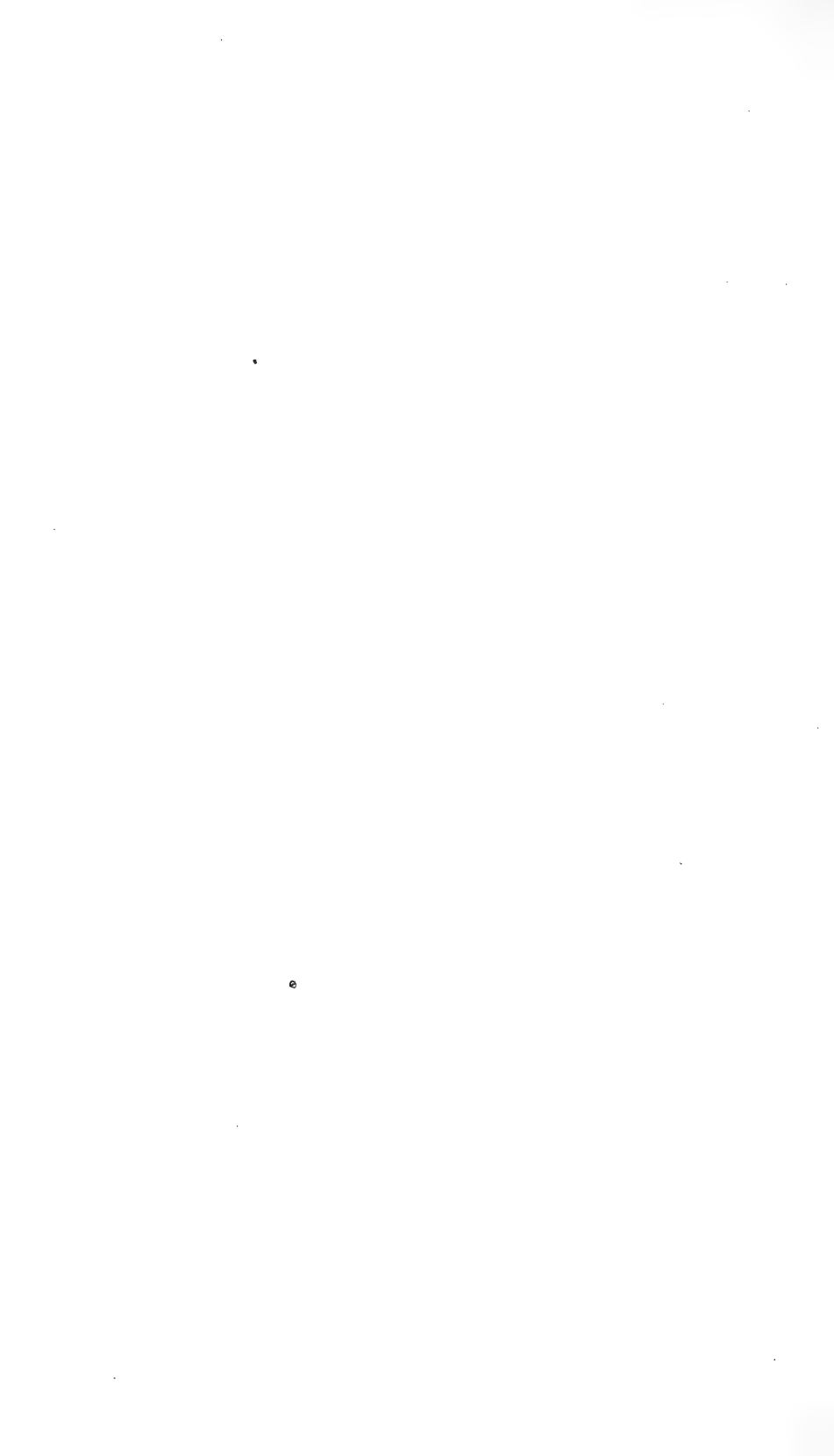


Fig. 4. 'Pelvis' and pelvic fins (in part) of a specimen of *Portheus molossus* loaned by Dr. O. P. Hay.

The most anterior hæmapophysis is found either on V. 53 or on V. 55. The hæmapophyses are placed on the anterior portions of the centra.

The sixteen anterior neural spines are cleft superiorly; between or just in front of them are fitted the wedge bases of the interneurals.



Article XXXII. — A FOSSIL PORCUPINE FROM  
ARIZONA.

By J. A. ALLEN.

The specimen here described is a skull in excellent preservation, lacking only the lower jaw and upper incisors, kindly presented to the Museum by Captain G. C. M. Godfrey, Medical Corps, U. S. Army, for whom the species is named. The skull was found in a volcanic fissure, about 50 feet below the surface, near the North Fork of the White River, on the White Mountain Apache Indian Reservation, Arizona. From its weight it is evidently somewhat mineralized. It is the skull of a very old animal, with well developed osseous crests and greatly worn teeth.

*Erethizon godfreyi*, sp. nov.

Type, No. 24204, a nearly complete cranium, from a volcanic fissure, White Mountain Apache Indian Reservation, Arizona. Collected and presented by Capt. G. C. M. Godfrey, U. S. Army.

Skull short and broad, with very heavy dentition and very small audital bullæ. Total length, 104.3; occipito-nasal length, 95.5; basal length, 93.5; basilar length (Henselian), 86; palatal length, 50; post-palatal length, 38; zygomatic breadth, 69; interorbital breadth, 35; width of rostrum at front border of nasals, 24; width of rostrum at inferior base, 18.5; palatal width at posterior border of last molar (outside to outside), 25; width of occiput, 44; width at outer meatus auditorius (extreme points of anterior border of meatus), 47.6; length of nasals, 40; width of nasals at anterior border, 23.5; length of upper tooththrow, 25; premolar, 9.5 x 8; m<sup>3</sup>, 6.3 x 7.3; audital bulla, 19 x 12.

This specimen further shows an interesting abnormality in the presence of a supernumerary molar on the left side, placed a little behind m<sup>3</sup>, the crown protruding from the external surface of the maxillary near its posterior border. It is about one third the size of a normal m<sup>3</sup>.

This species differs from California specimens of *E. epizanthus* in its much shorter and broader rostrum, much greater interorbital breadth, greatly reduced audital bullæ (19 x 12 against 22 x 16), and the much greater breadth of the molari-form teeth (p. 9.5 x 8 against 8 x 8; m<sup>3</sup> 6.3 x 7.3 against 5 x 5),

and especially the reduced length of  $m^1$  and  $m^2$ , which are much shorter anteroposteriorly than the premolar or  $m^3$ , instead of being longer, as in *E. epizanthus*. The existing *E. epizanthus conesi* Mearns of the same region is a much smaller form than *E. epizanthus*, with "enormous development of the audital bullæ," and is hence very different in size and other characters from the specimen here described. It is impossible from the nature of the deposit where it was found, to determine its geological age, but it may be considered as probably late Pleistocene, and as ancestral to both the eastern and western forms of the genus.

Two fossil species of *Erethizon* have heretofore been indicated, namely, *Hystrix (Hystriopsis) venustus* Leidy (1858), based on two detached molar teeth, from the Pliocene of Dakota; and *Erethizon cloacinus* Cope (1871), based on a last superior molar and a portion of a lower incisor, from the Port Kennedy, Pa., bone-cave. The first, perhaps doubtfully referable to *Erethizon*, obviously has no near relationship to the present species; the other, for geographical and other reasons, need not be further considered here.



### Article XXXIII. — THE TAMANDUA ANTEATERS.

By J. A. ALLEN.

The Tamanduas have a wide geographical distribution, extending throughout the warmer parts of America, from Paraguay to southern Mexico. They likewise vary greatly in size and coloration, but as a rule have all been referred, up to about 1889, to a single species, the *Myrmecophaga tetradactyla* of Linnæus, the *Tamandua tetradactyla* of recent authors, with the exception of the so-called Long-tailed Tamandua (*Tamandua longicaudata* Wagner), which differs markedly from the others in coloration and in the structure of the nasals, but not in the length of the tail, as the name erroneously implies. It is nearly uniform straw-color, thus lacking the peculiar pattern of coloration which characterizes the *T. tetradactyla* group, and stands sufficiently by itself (see this Bulletin, XX, 1904, p. 339) to be omitted from the present consideration.

A few other names may be assigned at once as synonyms of *tetradactyla*. These are: (1) *Myrmecophaga nigra* Desm. (ex Geoffroy MS.) Nouv. Dict. d'Hist. Nat., nouv. éd., XII, 1817), wholly black and probably a melanism; (2) *Myrmecophaga bivittata* Desm. (ex Geoffroy MS., *l. c.*), adopted by J. E. Gray in 1865 in place of *tetradactyla*.

In 1873, Gray (Hand-List of Edentate, Thick-skinned, and Ruminant Mammals, 1873, p. 27) gave names to two "varieties" of his *Tamandua bivittata* — "Var. 1. *Opisthomelas*," with the hinder part of the back black; and "Var. 3. *Opistholeuca*," with the hinder part of the back white. The first is from "Brazils," the other from Guatemala, Costa Rica, Ecuador, Brazils, etc. Both appear to have been ignored by subsequent writers. In 1899, Cope (Amer. Nat., XXIII, Feb., 1889, p. 132) based the name *Myrmecophaga straminea* on a single skin, the label of which had been lost, but which came either from the west central part of Rio Grande do Sul or Chapada, Matto Grosso, Brazil, — regions quite remote and zoologically quite different. In the same paper he

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founded the name *Myrmecophaga sellata* on a skin brought from Honduras to the World's Exposition at New Orleans. As will be shown later, neither of these names is at present entitled to serious consideration.

A series of nearly 60 specimens from the Santa Marta district of Colombia (nearly all taken at Bonda) affords ample material for the study of individual variation, not only in coloration but in size and cranial characters. The results of an examination of this material will be first recounted, and afterwards material from other localities will be considered.

An average Santa Marta specimen of the *T. tetradactyla* group is dark brown and yellowish white, the two colors generally arranged in sharply defined areas. A dark band (sometimes quite distinct) encloses the eye and extends forward to the side of the nose. A second very large dark area completely encircles the body, covering the ventral surface from the posterior border of the pectoral region to the base of the tail, the sides of the body, and the back from the shoulders to the lumbar region. It is usually divided for some distance down the middle of the back by a line of yellowish white extending from the shoulders posteriorly. From the dark area of the back a broad band of the same color runs forward and downward over the shoulders to the front border of the axillæ. The light-colored parts form two distinct areas wholly separated by the black of the body. The first covers the head and neck all around, the top of the shoulders, from which a V-shaped line extends down the middle of the back, and the whole of the fore limbs. The second light area includes the haired portion of the tail and the hind limbs, except the inside of the thighs, and extends forward more or less upon the rump and lower back.

This general type is endlessly modified, in specimens from the Santa Marta district, through individual variation, it being exceptional to find two specimens closely similar. These modifications affect the pattern of markings as well as the general tone of the coloration. The following are some of the principal variations.

VARIATION IN PATTERN. — *The Dark Areas.* — (1) The dusky eye-stripe is generally not strongly differentiated from the surrounding parts; it varies from a narrow dusky line, barely enclosing the eyes posteriorly, to a much broader indistinct band extending back to the base of the ears.

(2) The band encircling the body varies in antero-posterior extent, usually reaching, on the dorsal surface, from the posterior part of the shoulders to a little beyond the hips, and on the ventral surface from the posterior part of the pectoral region to the base of the tail, and over the proximal half of the inner surface of the hind limbs. Its posterior extension varies between wide limits, it sometimes only reaching to the line of the hips, and again extending to, and even somewhat upon, the base of the tail. These extremes cover, respectively, Gray's "*var. opisthomelas*" and "*var. opistholeuca*." Anteriorly, if we include the shoulder bands, the variation is much greater. These may be very narrow or very broad, ranging in width from 10 to 40 mm. at their narrowest point. They usually are wider anteriorly than at the middle, but sometimes gradually diminish in width as they proceed forward, thus tapering anteriorly instead of widening to twice their mid-diameter.

*The Light Areas.* — The light areas of course vary conversely with the extent of the dark areas. But a special variation consists in the extent of the light median dorsal line. This, in a few specimens, is entirely absent; in a few others it extends the whole length of the back, completely dividing the dorsal black area into halves. Usually it is a broad, symmetrically wedge-shaped mark, extending back from the nape to enclose the hair-whorl at the withers, and then, abruptly narrowing to a width of about 15 mm.; continues posteriorly, with constantly diminishing breadth, to the point of disappearance. It varies in width, when present, from a sharply defined conspicuous band to obsolescence, when it is merely indicated by an irregular line of scattered whitish hairs. In several specimens there is not only no trace of a median dorsal light line, but the whole of the interscapular area and nape are dusky, only a little less dark

than the shoulder bands, which are thus internally obscurely defined.

VARIATION IN COLOR. — The light and dark areas not only vary in extent and form, as above described, but in color. The dark areas vary in tone from light reddish brown, or brownish rufous, to clear black, the average condition being dark brown. The posterior border of the dark area on the back is sometimes sharply defined, and sometimes shades off gradually into the light color of the rump. This is due to the hairs being dark basally at the edge of the white area and light apically, and the transition is either abrupt or gradual, according to the extent of the junctional area covered by light-tipped hairs. Also there are not infrequently light-tipped hairs on the back and sides of the body within the dark area, giving a superficial yellowish-gray wash to the surface, as is commonly the case in one-fourth- to half-grown young.

The light areas vary from nearly clear white (several specimens) to deep rusty yellow. The nuchal region is generally much deeper colored than the limbs and tail. In an average specimen the light parts are yellowish white or pale buffy, shading to ochraceous buff, or even ochraceous on the nuchal region.

SKULLS. — The skulls are found to be remarkably constant in their characters. A series of 24 adult skulls selected at random for study shows that the skull varies very little individually, or with age. It is smooth or wholly without crests or ridges, even in old age. A young adult skull is distinguishable from a very old skull only by the comparative obsolescence of the sutures and the denser structure of the bone in the latter. The variation in size is not great, as is shown by the subjoined table of measurements (p. 397), which includes measurements of young adult, middle-aged, and old skulls. One specimen (No. 23423) is noticeably different from the others in being unusually short and broad, with an unusual convexity of the interorbital region. Another (No. 14675) differs in the rostral portion of the skull being unusually narrow and deep. The nasals vary in depth and

outline, especially in the outline of the posterior border, which is usually convex posteriorly, but may be square, or even slightly emarginate. They are usually slightly narrower near the middle than at the front border, and expand abruptly at their extreme postero-lateral border, varying from this general form only slightly in different individuals. The constancy of the skull characters is thus in strong contrast with the extreme variability of the coloration.

Having passed in review the large Santa Marta series we may take up the scanty material available for examination from other localities, namely, Chapada, Brazil (6 skulls and 1 skin), Chiriqui, Panama (4 skulls and 4 skins), and Passa Nueva, State of Vera Cruz, Mexico (5 skulls and 6 skins), and single specimens from elsewhere,

(1) The Chapada series of skulls stands apart from all the others in (a) the relative shortness of the nasals, due mainly to the great anterior extension of the frontals, which thus gives a short rostrum; and (b) in the greater posterior extension of the occipital condyles beyond the plane of the occiput, as expressed in the tables of measurements<sup>1</sup> given beyond. In this series the basal length of the skull slightly exceeds the occipito-nasal length, while in all the specimens from elsewhere it is considerably less. (c) The braincase is also flatter or much less convex, both antero-posteriorly and transversely, than in the skulls from other localities.

(2) The Santa Marta series differs from the Chapada series in all the points above specified, and from this and all the other series by much smaller size, the skulls averaging one tenth less than those from any other locality, with correspondingly smaller external dimensions, as will be shown beyond. The average occipito-nasal length of the skull is only 118 mm. against 131 in Chiriqui specimens, and the total length of the

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<sup>1</sup> In this connection it should be explained that in all cases the basal length is taken from the posterior border of the occipital condyles to the front border of the maxillaries, for the reason that in most museum skulls the premaxillaries have either been wholly lost or are detached from the skull, with which in life their connection is merely ligamentary. They can be preserved attached to the skull only by the greatest care in its preparation; and then they are liable to become separated later, even with careful handling; and the same is true of the malar bone.

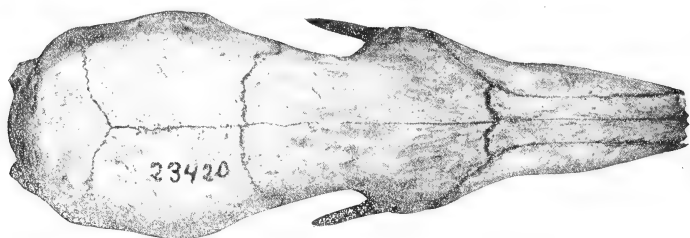


Fig. 1. *Tamandua tetradactyla instabilis*, Bonda, Colombia.  $\frac{3}{4}$  nat. size.



Fig. 2. *Tamandua tetradactyla chapadensis*, Chapada, Matto Grosso, Brazil.  $\frac{3}{4}$  nat. size.



Fig. 3. *Tamandua tetradactyla tenuirostris*, Passa Nueva, Vera Cruz, Mexico.  $\frac{3}{4}$  nat. size.

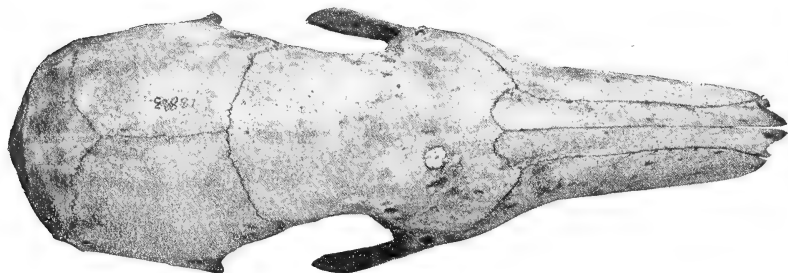


Fig. 4. *Tamandua tetradactyla chiriquensis*, Boqueron, Chiriqui, Panama.  $\frac{3}{4}$  nat. size.

animal in the flesh is 957 mm. against 1155 in the Chiriqui form.

(3) The distinguishing feature of the Vera Cruz skulls is the narrowness of the whole preparietal portion of the skull in comparison with any of the other forms, the braincase being of about the usual width but flat, with the interorbital and preorbital portions of the skull, especially the latter, slender and tapering. It shares in a measure the backward position of the occipital condyles with the Chapada form.

(4) The Chiriqui skulls are the largest of all. The braincase is relatively narrow, in comparison with the anteorbital region, and also very convex antero-posteriorly in contrast with the depressed and very flat frontal region. The occipital condyles are anterior in position, in strong contrast with the Chapada and Vera Cruz forms. The great length of the rostrum distinguishes it also from the Chapada and Santa Marta types, from which latter it further differs in its large size.

With these four series of skulls before one for comparison, the differences *inter se* are impressive and important (see Figs. 1-4), though hard to express adequately in descriptions. They certainly indicate that the *Tamandua* group of Anteaters is subject to a degree of local variation, at least in the skulls, entitled to recognition. Although some of the forms, and possibly all, are subject to a wide range of individual variation in color, there are still other features by which they, and doubtless other forms, can be separated.

In view of the apparent continuity of the distribution of the group, it seems best to treat the local forms above indicated as merely subspecies. As a starting-point, it seems proper to take Guiana as the type locality of the Linnæan *Myrmecophaga tetradactyla*, since it was based on the accounts of early writers whose material or observations were made either in the Guianas or in "Brazil." It is at least following the precedents established in similar cases to accept Guiana as the type locality for *tetradactyla*.

***Tamandua tetradactyla chapadensis*, subsp. nov.**

Fig. 2, p. 390.

*Myrmecophaga bivittata* COPE, Amer. Nat., XXIII, Feb., 1889, 132. Chapada specimens. (Separates dated May 25, 1889.)

*Myrmecophaga ?sellata* COPE, *ibid.*, p. 133 (the Chapada specimen only).

*Tamandua tetradactyla* THOMAS, Proc. Zool. Soc. London, 1903, II, 242 (April 1, 1904).

Type, No. 369, ♀ ad., skull, Chapada, Matto Grosso, Brazil, July, 1885; coll. Herbert H. Smith. Cotype, No. 1417, skin, same locality and collector.

Size medium; nasals short; frontals prolonged anteriorly; occipital condyles extending considerably beyond the occipital plane. Occipito-nasal length, 125; basal length (without premaxillaries), 127; greatest breadth at front edge of orbits, 37; width of braincase, 42; length of nasals, 42.5 (equal to width of braincase). (For further skull measurements see table, p. 398; for comparison with allied forms see p. 396.)

Light areas ochraceous buff; shoulder bands as usual in the group; dark area of body reaching to base of tail; light dorsal stripe extending to posterior third of dark area; hairs of dark area very long, light buffy ash for basal half and tipped (many of them) with the same color, mixed with many wholly black, giving a grizzled grayish black general effect.

The pelage is much longer, coarser, and heavier, and the light band at the base of the hairs several times broader than in any of the Santa Marta specimens. Unfortunately external measurements are lacking,<sup>1</sup> but apparently it is a short-tailed form, like the Santa Marta animal, in comparison with the Mexican and Panama forms.

Cope distinguished his *M. bivittata straminea* as being straw-color, with two black bands on the shoulders and a black patch on the abdomen. As the locality is in doubt, and no cranial characters were given, it must remain at present indeterminable. The common form, here named *chapadensis*, of which he had several specimens (part of the series here under consideration), he distinguished as *M. bivittata* Desm. (= *tetradactyla* Linn.).

***Tamandua tetradactyla instabilis*, subsp. nov.**

Fig. 1, p. 390.

*Tamandua tetradactyla* SCLATER, Proc. Zool. Soc. London, 1871, 546, pl., xliii (colored figure of a Santa Marta specimen).

<sup>1</sup> It is to be regretted that Mr. Thomas failed to publish the flesh measurements of the large series of Chapada specimens collected for the British Museum by Mr. A. Robert (Cf. Proc. Zool. Soc., 1903, II, p. 242). Such measurements are always of the greatest value to subsequent investigators.



Type, No. 23420, ♀ ad., Bonda, April 7, 1899; coll. Herbert H. Smith.

Size small; tail short, about .80 of length of head and body. Coloration and pattern of markings variable. Type, a medium example: Dark area blackish brown with a tinge of reddish, extending, below, from the chest to the tail, including proximal portion of the hind limbs, and above from the shoulders to the hips, with a median extension to the base of the tail, with two bands, averaging about 15 mm. wide, extending obliquely forward and downward to the front edge of axillæ; light area straw-yellow, brightening to pale ochraceous on the posterior part of head, sides of neck and nuchal region, from which a median dorsal stripe, about 10 mm. wide at its inception, runs backward to a point opposite the hips; an indistinct dusky band on the side of the face extending back only to the posterior canthus of the eye.

About half the specimens in a series of 40 now available for inspection, conform in pattern, in a general way, to this type, but the color of the dark area varies from pale reddish brown to black, and the light areas from nearly clear white to deep ochraceous, generally most intense on the nuchal region, with the light median dorsal stripe varying in extent, sometimes terminating about the middle or anterior third of the dark area or extending entirely through it, dividing it into right and left halves. In four specimens the light median line is cut off anteriorly at the hair-whorl on the withers by the interscapular and nuchal regions being dark rusty brown, scarcely different in color from the adjoining dark areas. In another specimen, in which the nuchal-interscapular space is quite as dark as the body, there is nowhere any trace of a light median stripe. In specimens in which the dark areas are nearly black, the white areas may be either nearly pure white or strongly ochraceous, darkening on the nuchal region to ochraceous brown.

*Measurements.*—Type: Total length, 979; head and body, 546; tail, 433. Fourteen specimens give the following: Total length, 957 (865-1056); head and body, 542 (513-607); tail, 414 (347-465). Skull, type, occipito-nasal length, 115; width of braincase, 39; length of nasals, 39. (For additional measurements of the skull see table, p. 397; for further comparison with other forms see p. 396.)

This is another Santa Marta form which differs from its nearest allies in markedly smaller size, paler tints, and excessive color variability. The other especially notable cases are the Raccoon (*Procyon cancrivorus proteus*) and the Tayra (*Tayra barbara irara*); the Kinkajou (*Potos flavus megalotus*) and the Peccary (*Tagassu torvum*) are also small forms.

Other cases of small size and instability in color occur among the Rodents and Marsupials.

As Gray cites under his var. *opistholeuca* (Hand-List Edentates, etc., p. 27) Sclater's figure of a Santa Marta specimen, it may be claimed that Gray's name should be adopted for the Santa Marta form. He indicated no type and gave no description beyond the phrase "Rump to the middle of the back white," which is wholly meaningless in view of the variability of Anteaters in general in respect to this feature of the coloration. He enumerates under the name *opistholeuca* 10 specimens, 2 of which are from New Grenada, 3 from Guatemala, 1 from Costa Rica, 1 from Brazil, and 2 from "tropical America." It is safe to say that none of these specimens are likely to prove closely related to the Santa Marta form. The chance citation, therefore, of Sclater's then recently published colored plate seems insufficient to fix Gray's name *opistholeuca* on the Santa Marta animal.

It is of interest to note that Sclater on receiving, later, other living specimens of the Tamandua, "probably from Brazil" (*l. c.*, p. 624, 625), noted "well-marked points of difference" between them and the Santa Marta specimen.

***Tamandua tetradactyla tenuirostris*, subsp. nov.**

Fig. 3, p. 390.

Type, No. 17272, ♀ ad., Passa Nueva, State of Vera Cruz, Mexico, April 11, 1901; coll. A. E. Colburn.

Size large; tail long, equalling the length of head and body. Coloration and pattern of markings apparently showing little variation. Type: Light areas white faintly tinged with yellowish, the yellow tint a little stronger on the nuchal-interscapular space than elsewhere; median light dorsal line extending to hips; dark area purplish black, sharply defined against the white, and reaching the base of the tail, both above and below.

Four other adults and one young specimen agree almost exactly with the type in coloration and pattern of the markings, except in the posterior extension of the black on the dorsal surface, which in some extends on to the base of the tail and in others terminates on the rump. In a fifth specimen the black extends only to the hips, and is divided the whole length by the light median line; the shoulder bands are greatly narrowed posteriorly and become obsolete at their junction with the black area behind the shoulders. The black area in two specimens is purplish black and in the others clear black.

*Measurements.*—Total length, 1185; head and body, 585; tail, 600; hind foot, 95. Three adults, all females, measure, total length, 1178 (1155–1195); head and body, 598 (583–627); tail, 580 (568–600); hind foot, 94 (93–95). Skull, occipito-nasal length, 133; width of braincase, 42; length of nasals, 55 (much longer than width of braincase). Four skulls measure, total length, 127.5 (122–133); width of brain case, 41 (40–42); length of nasals, 47.2 (43–51).

The present form is especially characterized by the narrow and tapering form of the skull anterior to the braincase. In size it agrees well with the Chiriqui form, described below, but in coloration the light area is clearer white, and the form of the skull is strikingly different.

The relation of Cope's *Myrmecophaga sellata* (Amer. Nat., XXIII, 1889, p. 133), founded on a somewhat imperfect skin, without skull, from "Honduras," to the present form cannot now be determined. His description of the color and markings of this specimen does not, however, agree well with the present series from Vera Cruz.

***Tamandua tetradactyla chiriquensis*, subsp. nov.**

Fig. 4, p. 390.

Type, No. 18883, ♀ ad., Boqueron, Chiriqui, Panama, Oct. 16, 1901; coll. J. H. Batty.

Size large; length of tail about equal to length of head and body. Dark areas deep brownish black; light areas dull brownish buffy white, instead of nearly clear white as in *T. t. tenuirostris*, more deeply colored on the nuchal-interscapular region. The black extends for nearly four inches on the basal portion of the tail, but mixed more or less with light hairs. The light median dorsal stripe terminates considerably in front of the hips. Two other specimens are similar, with the black on the base of the tail equally extensive but clearer black.

*Measurements* (type).—Total length, 1180; head and body, 610; tail, 555; hind foot, 100; ear, 50. Two other females, not fully adult (as shown by the skulls), measure, respectively: Total length, 1120, 1165; head and body, 540, 580; tail 580, 600; hind foot, 90, 90; ear, 40, 45. Skull (type), occipito-nasal length, 132.5; width of braincase, 42; length of nasals, 55. Another younger skull (female) measures a little less, as follows: Occipito-nasal length, 129; width of braincase, 41; length of nasals, 51.

An adult female from the Rio Cauquita, southwestern Colombia, is exactly like the Boqueron specimens in size,

coloration, and cranial details. A skull, without skin, from near San José, Costa Rica, is also indistinguishable from the adult Boqueron skulls. Apparently *T. t. chiriquensis* will be found to range from Costa Rica to the Cauca region of western Colombia. A young specimen, from Boquete (alt. 5500 feet), Chiriqui, has the light area clear white, but in cranial characters agrees with the Boqueron specimens.

The relation of Cope's *Myrmecophaga sellata*, already referred to, to *T. t. chiriquensis* and *T. t. tenuirostris* can only be determined by an examination of a series of specimens from the type locality.

The four subspecies of *Tamandua tetradactyla* above described fall into two groups characterized by the character of the rostral portion of the skull, as follows:

- A. Rostral portion of the skull short and broad, with the ratio of nasals to occipito-nasal length as 35 to 100, and the ratio of the greatest breadth of the skull at the anterior edge of orbits to the occipito-nasal length as 28.5 to 100; length of nasals about equal to width of braincase.
  - a. Size small (occipito-nasal length, 118).....*instabilis*.
  - b. Size medium (occipito-nasal length, 124.5).....*chapadensis*
- B. Rostral portion of the skull long, with the ratio of nasals to occipito-nasal length as 39 to 100; nasals much longer than the width of the braincase.
  - a. Rostral portion of the skull narrow; ratio of greatest breadth of skull at anterior edge of orbits to occipito-nasal length as 24.4 to 100.....*tenuirostris*.
  - b. Rostral portion of skull broad; ratio of greatest breadth of skull at anterior edge of orbits to occipito-nasal length as 27.5 to 100.....*chiriquensis*.

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EXTERNAL MEASUREMENTS OF 19 SPECIMENS OF *Tamandua tetradactyla instabilis*.

[The determination of the sex of the Santa Marta series has been made from an examination of the skins, adults being readily distinguishable by the presence of a pectoral pair of well-developed nipples in the females. The absence of nipples has been taken to indicate males. Where no sex is indicated the specimen is a skull or skeleton, and hence the sex indeterminable. The external measurements, "total length" and "tail," are from the collector's labels. All the specimens are from Bonda, near Santa Marta, Colombia.]

14666	♂	Total length, 945; head and body, 518; tail vertebræ, 427.
14672	♂	" " 941; " " " 533; " " 408.
23563	.	" " 1018; " " " 607; " " 408.
23440	"	" " 939; " " " 543; " " 396.
23405	♀	" " 865; " " " 513; " " 347.
23416	♂	" " 978; " " " 570; " " 408.
23417	♀	" " 992; " " " 559; " " 433.
23419	♀	" " 981; " " " 579; " " 402.
23420	♀	" " 979; " " " 546; " " 433.
23422	♀	" " 929; " " " 559; " " 370.
23423	♀	" " 941; " " " 533; " " 408.
23424	♂	" " 992; " " " 584; " " 408.
23426	♀	" " 967; " " " 534; " " 433.
23427	♀	" " 992; " " " 533; " " 459.
23430	"	" " 967; " " " 521; " " 446.
23432	♂	" " 891; " " " 483; " " 408.
23434	"	" " 1056; " " " 591; " " 465.
23436	"	" " 1018; " " " 559; " " 459.
23440	"	" " 929; " " " 534; " " 395.
Average Total length, 964; head and body, 547; tail vertebræ, 427.		

MEASUREMENTS<sup>1</sup> OF 20 SKULLS OF *Tamandua tetradactyla instabilis*.

Mus. No.	Sex.	Occip.-nasal length.	Basal length.	Antorb. breadth.	Interorb. breadth.	Width of brain-case.	Width across bullæ.	NASALS.			
								Length.	Width at front border.	Least width.	Width at post. border.
14667	y. ♀	118.5	116	30	23	41	36	42	7	6	10
14673	m. ♀	119	115	33	23.5	40	33.5	43	8	8	10.5
14675	o. ♀	116	113	32	23	39	34.5	42	8	7	11
14666	y. ♂	110	108	—	22	38	33.5	37.5	7	7	12
14866	o. ♂	119	119	34	25	41	33	43.5	8	6.5	11
14664	y. ♀	113	109	32.5	22.5	39	36	41	8	8	13
14668	o. ♂	118	115	33	24	40	34.5	44.5	9	5.5	13
14669	o. ♀	110	106	30.5	22.5	39	33.5	37	8	7	12
23410	o. ♂	119.5	115.5	32	24	40.5	34	43	10	8	14
23417	o. ♀	120	117	34	24.6	40	34	45	10	8	12
23408	o. ♀	119	115	34	24.3	41.5	36	41.5	9	8	13
23409	o. ♂	115	112	31	23.4	40	33	42	8	8	14
23422	o. ♀	121	119	34	25.6	40	33.5	46	9	8	13.5
23420	m. ♀	115	112	33	22.5	39	34.5	39	9.3	8	12
23426	o. ♀	118	114	32	24	39.3	33	41.5	8	7.5	12
23425	o. ♂	116	112	32.5	23	40	33.5	41	10	9	14
23427	o. ♀	110	110	33	23	—	—	39	8	8.5	12
23423	o. ♀	110	108	34.7	25	41	34	38.5	9	8	11
23424	o. ♂	119.5	115.5	33	24	39	35.3	48	9	7	12
23428	o. ♀	121	118	34	25	41.5	37.5	41	10	10	14
Average..		118	113.5	32.8	23.7	39.4	34.2	41.8	8.7	7.7	12.3

<sup>1</sup> Explanation of Measurements.

Occipito-nasal length = front edge of nasals to most projecting part of occipital plane.

Basal length = front edge of maxillaries to posterior border of occipital condyles, the premaxillaries being usually detached or wholly lacking in museum specimens.

Antorbital breadth = greatest breadth at front edge of orbits.

Width across bullæ = distance between outer edges of bullæ.

The letters y., m., and o., placed before the sign for sex, refer to age, and mean, respectively, young, middle-aged, and old.

Sex determined as explained in the preceding table of external measurements.

MEASUREMENTS OF TAMANDUA SKULLS.<sup>1</sup>

Mus. No.	Sex.	Occip.-nasal length.	Basal length.	Antorb. length.	Interorb. breadth.	Width of brain-case.	Width across bullæ.	NASALS.			
								Length.	Width at front border.	Least width.	Width at post. border.
<i>T. chapadensis</i> . <sup>2</sup>											
370	m. ♀	121	121	33.5	25.5	41	36	41	7	6	11
371	y. ♀	114.5	—	33.5	24	40	36	42.5	8	7	11
372	o. ♀	133	132.5	37	28	43	39	41.5	7.5	7.5	11.5
373	o. ♀	125.5	123	35	27	43	38	43.5	8	7.3	12.5
368	o. ♀	127	124.5	37	26	42	37.5	45	9	7.3	15.5
369	o. ♀	125	127	37	25.5	42	36	42.5	7	5.5	10
Average..		124.3	125.6	35.5	26	42	37	42.7	7.8	6.8	11.0
<i>T. chiri-quensis</i> . <sup>3</sup>											
18883	o. ♀	132.5	124	38.5	27	42	36.5	55	10	7	14
18884	m. ♀	120	126	33.5	24.3	41	37	51	8	6	12.5
14222	y. ♀	120.5	125	34.8	24	40	37	49	8	7	12
10087	o. ♀	124.5	120	35.3	25.3	39.3	35.5	47	8	6.5	10.5
Average..		120	124	35.5	25	41.8	36.5	50.5	8.5	6.6	12.2
<i>T. teni-rostris</i> . <sup>4</sup>											
17270	o. ♀	130	126	32	24	41	35	51	8.5	7.5	10
17271	m. ♀	124	123	32	24	40.5	34	43	7	8	9.3
17273	m. ♀	122	119	31	24	40	34	44	7.5	7.3	10
17272	o. ♀	133	132.5	32.3	24	42	37	51	8	8	11
Average..		127	125	32	24	40.9	35	47.2	7.8	7.7	10.1
<i>T. longi-audata</i> . <sup>5</sup>											
16035	o. ♀	131.5	128	35	26	42.5	35	48	9	8	12
16036	m. ♀	124	121	35	26.5	40	36	41	8	7	11.5
17561	y. ♀	125	121	34.8	24.5	40.5	35	48.5	9	8.5	13
21303	m. ♀	125	121.5	33	23	39	35	45.3	9	7	10.5
Average..		126.4	123	34.5	25	40.5	35.2	45.7	8.8	7.6	11.8

<sup>1</sup> For explanation of measurements see preceding table.<sup>2</sup> All from Chapada, Matto Grosso, Brazil.<sup>3</sup> Nos. 18883 and 18884, Boqueron, Chiriqui, Panama; No. 14222, Rio Cauquita, Colombia; No. 10087, near San José, Costa Rica.<sup>4</sup> All from Passa Nueva, Vera Cruz, Mexico.<sup>5</sup> All from Caura district, Venezuela.

**Article XXXIV.**—LIST OF BIRDS COLLECTED IN  
ALASKA BY THE ANDREW J. STONE  
EXPEDITION OF 1903.

By FRANK M. CHAPMAN.

The collection on which the following report is based contains 317 birds and 35 sets of eggs. It was made by Mr. M. P. Anderson who accompanied Mr. Stone as a collector of small mammals and birds. The latter, however, were considered of secondary importance, Mr. Anderson's time being chiefly devoted to the collection and preservation of small mammals, of which he secured over 800 specimens.

The localities at which collections were made are described by Dr. J. A. Allen in a report on the mammals procured by the expedition (this Bulletin, XX, pp. 274, 275). In this connection, therefore, it will be necessary only to name them with the dates on which they were visited, as follows: Alaska Peninsula: Herendeen Bay and Muller Bay, May 19–June 19. Kenai Peninsula: Seldovia, June 26–August 3; Barbori, near Homer, August 6–8; Sheep Camp, Sheep Creek, August 9–September 3; Caribou Camp, timber-line, September 3–9; Moose Camp, timber-line, September 25–October 8.

1. **Gavia imber.** LOON.—One adult female, Seldovia, June 30.

2. **Gavia lumme.** RED-THROATED LOON.—One adult female, Seldovia, June 30; one set of two eggs, Seldovia, July 1.

3. **Lunda cirrhata.** TUFTED PUFFIN.—Twelve adults, Bird Island, Seldovia, July 10 to 23; six eggs, same locality, July 10 to 11.

4. **Fratercula corniculata.** HORNED PUFFIN.—Thirteen adults, Seldovia, July 1 to 24; two eggs, Bird Island, Seldovia, July 15.

5. **Brachyrhamphus brevirostris.** KITTLITZ'S MURRELET.—One adult male in breeding plumage, "opposite Homer," August 3. This capture appears to extend the known range

of this species some 700 miles to the eastward, it apparently not having been previously recorded from further east than Unalaska. (See Nelson and Turner.)

According to Ogilvie-Grant (Cat. B. M. XXVI, 593) the type of *Uria brevirostris* Vigors, 1828, is to be referred to *Brachyrhamphus kittlitzii* Brandt, 1837, and authors generally. Consequently *brevirostris* should replace *kittlitzii* in the A. O. U. 'Check-List of North American Birds.'

6. **Cephus columba.** PIGEON GUILLEMOT. — Eight adults, Seldovia and Bird Island, July 4 to 28.

7. **Uria troile californica.** CALIFORNIA MURRE. — Eleven adults, Bird Island, Seldovia, July 10 to 24, and eleven eggs, same locality, July 24.

8. **Rissa tridactyla pollicaris.** PACIFIC KITTIWAKE. — Six adults, three nestlings, and two eggs, Bird Island, Seldovia, July 24; one nestling, "opposite Homer," August 3.

9. **Larus glaucescens.** GLAUCOUS-WINGED GULL. — Two adults, Seldovia, July 18; one adult and nine young, Seldovia, Bird Island, July 11 to 24. The young range in age from specimens about a week old (July 11) to one almost ready to fly (July 20). A male taken on Bird Island, July 12, is in worn, immature plumage of the preceding winter, which it apparently failed to moult.

10. **Larus brachyrhynchus.** SHORT-BILLED GULL. — A bird of the year, in immature gray plumage, from "opposite Homer," Aug. 3.

11. **Sterna paradisæa.** ARCTIC TERN. — One immature female, Bird Island, Seldovia, July 26.

12. **Phalacrocorax pelagicus robustus.** VIOLET-GREEN CORMORANT. — Eight adults, Bird Island, Seldovia, July 10 to 26. A few neck and rump plumes persist in a male taken July 12. The flank patches are present in all the specimens except in those taken July 24 and 26.

13. **Merganser serrator.** RED-BREASTED MERGANSER. — Four adult females, Barbori, Sheep Creek, August 28. The body is in spring plumage, the wing-quills, however, are new and about half-grown.

14. **Histrionicus histrionicus.** HARLEQUIN DUCK. — Three



adult females, Bird Island, Seldovia, July 22 and 23. These specimens wear a plumage resembling that of the female. All the wing-quills have been moulted. In one specimen (July 23) new quills are sprouting; they appear nearly simultaneously, the primaries and secondaries being about equally developed, while the tertials are somewhat more advanced.

15. **Somateria v-nigra.** PACIFIC EIDER. — Six adult females, one adult male, Bird Island, Seldovia, July 22 to 25; one adult female, "opposite Homer," August 3. One set of four, and one of five eggs, Bird Island, July 12. The male specimen (July 23) has the head and neck grayish dusky with some remains of the breeding plumage; the body, wings, and tail are in much worn breeding plumage.

16. **Oidemia perspicillata.** SURF SCOTER. — One adult male in breeding plumage, Bird Island, Seldovia, July 28.

17. **Phalaropus lobatus.** NORTHERN PHALAROPE. — A female in juvenal plumage, August 3, "opposite Homer."

18. **Arquatella couesi.** ALEUTIAN SANDPIPER. — Three males in breeding plumage, one set of four, and one set of five eggs, Muller Bay, June 9.

19. **Actitis macularia.** SPOTTED SANDPIPER. — One adult female in breeding plumage, Seldovia, July 20; two females in juvenal plumage, Sheep Creek, August 25 and 28.

20. **Arenaria melanocephala.** BLACK TURNSTONE. — One adult female, Bird Island, Seldovia, July 27; three adult males, "opposite Homer," August 3.

21. **Canachites canadensis osgoodi.** ALASKA SPRUCE GROUSE. — Twenty-nine specimens as follows: Seldovia, June 30, adult female and seven chicks; July 3, adult female; Bird Island, July 11, adult female; Barbori, Sheep Creek, August 6 to 8, four adult females in all of which post-nuptial moult has begun, and three young in juvenal plumage; August 28 to September 1, two adult males in winter plumage, two adult females completing the post-nuptial moult, four young males in post-juvenal moult; Sheep Camp, Sheep Creek, August 15 to 23, two adult males in winter plumage; Moose Camp, October 2 and 8, two adult males in winter plumage.

October, 1904.]

22. **Lagopus lagopus.** WILLOW PTARMIGAN. — One adult male in summer plumage, Muller Bay, May 27.

23. **Accipiter atricapillus striatulus.** WESTERN GOSHAWK. — One immature female, Barbori, Sheep Creek.

24. **Archibuteo lagopus.** ROUGH-LEGGED HAWK. — Two females and a male, Muller Bay, May 22 and 24; one set of three eggs, Herendeen Bay, May 17. The females are virtually indistinguishable from some, and even paler than other, European specimens in the Museum collection; the male is in black and rusty plumage.

Examination of the specimens of this species in the Museum collection renders questionable the propriety of recognizing a New World form. The more frequent occurrence of melanistic specimens in this country is assuredly not sufficient ground for subspecific separation.

25. **Haliaeetus leucocephalus alascanus.** ALASKAN BALD EAGLE. — One set of three eggs, taken at Muller Bay, May 22.

26. **Falco rusticolus gyrfalco.** GYRFALCON. — An adult female, Muller Bay, May 24.

27. **Falco columbarius.** PIGEON HAWK. — An adult male, Seldovia, June 28.

28. **Bubo virginianus saturatus.** DUSKY HORNED OWL. — Two adult males, one from Sheep Creek, August 28, and one from Caribou Camp, September 8. These birds doubtless represent the *Asio magellanicus lagophonus* of Mr. Oberholser (Proc. U. S. Nat. Mus., XXVII, 1904, p. 185) but I have not sufficient material to establish to my satisfaction the claims of this form to recognition, and in the absence of action by the A. O. U. Committee on the generic, specific, and subspecific titles proposed, I employ the nomenclature of the 'Check-List.'

29. **Surnia ulula caparoch.** AMERICAN HAWK OWL. — A female, Sheep Creek, August 21; a male, Moose Camp, September 30.

30. **Dryobates pubescens nelsoni.** NORTHERN DOWNY WOODPECKER. — An adult male, Moose Camp, September 30.

31. **Picoides americanus fasciatus.** ALASKAN THREE-TOED WOODPECKER. — Seldovia, July 20 to 30 three adults.

32. **Pica pica hudsonica.** AMERICAN MAGPIE. — Sheep Creek, one adult, August 31, and a male in juvenal plumage, August 4; Moose Camp, one adult, October 3.

33. **Cyanocitta stelleri borealis.** KENAI JAY. — Two males and two females in breeding plumage, Seldovia, June 30 to July 22; three specimens in juvenal plumage, July 22. Compared with a series of sixteen birds in breeding plumage from the coast of British Columbia the four adults are appreciably darker and less brown, the crest especially being sooty black with a barely perceptible tinge of brown. The differences, while less pronounced than those which exist between fall specimens from Homer, Alaska, and British Columbia and Vancouver, are sufficiently marked, in my opinion, to warrant the recognition of an Alaskan form of this jay. It should be borne in mind that, as in other species having no spring moult, the fresh or fall plumage constitutes the really characteristic dress, and in essentially non-migratory species comparisons between specimens in this plumage should be made rather than with spring specimens in which the differentiating characters may be lost or absent through fading or abrasion.

It is of importance to add that the differences shown by the adults also appear in the young juvenal plumage, the three specimens taken July 22 at Seldovia being much sootier than a bird in corresponding plumage taken at Mt. Lehman, B. C., July 18.

34. **Perisoreus canadensis fumifrons.** ALASKAN JAY. — Six specimens, Sheep Creek and Moose Camp, August 6 to September 26.

35. **Corvus caurinus.** NORTHWEST CROW. — Three adults, Seldovia, July 4; three juvenals, Seldovia, July 4 and 12.

36. **Corvus corax principalis.** NORTHERN RAVEN. — One juvenal male, Seldovia, July 4.

37. **Loxia leucoptera.** WHITE-WINGED CROSSBILL. — One adult male, August 7, one female, September 9, Sheep Creek.

38. **Acanthis linaria.** REDPOLL. — Two adult females, Seldovia, July 8, and Sheep Creek, August 11; one juvenal, Seldovia, June 29.

39. *Passerina nivalis*. SNOWFLAKE. — An adult male from Herendeen Bay, May 19, is clearly to be referred to *nivalis* rather than to *townsendi*. The wing measures 112 mm.

40. *Passerculus sandwichensis*. SANDWICH SPARROW. — Ten adults, May 26 to June 9, Muller Bay. Nine males average, wing, 76; exposed culmen, 11 mm. In one specimen the wing measures 73, the exposed culmen, 10 mm, a fact which, in connection with the average measurements given, indicates the intergradation of this and the next form at this point.

41. *Passerculus sandwichensis alaudinus*. WESTERN SAVANNA SPARROW. — Nineteen specimens, Seldovia and Sheep Creek, June 26 to August 16. Specimens taken July 15, August 11 and 13 are in juvenal plumage. Seven males average, wing, 74; exposed culmen, 10.5 mm.

42. *Zonotrichia coronata*. GOLDEN-CROWNED SPARROW. — Four adults, Muller Bay, June 4 and 6; one adult female, Seldovia, June 26.

43. *Junco hyemalis*. SLATE-COLORED JUNCO. — Two adults, July 8 and August 11, one juvenal, August 2, Seldovia; one specimen in winter plumage, Sheep Creek, August 30.

44. *Melospiza cinerea kenaiensis*. KENAI SONG SPARROW. — Seven adults, June 27 to July 12; four juvenals, June 27 to July 30, Seldovia.

45. *Passerella iliaca unalaschensis*. SHUMAGIN FOX SPARROW. — Eight adults, May 19 to June 8, from Muller Bay, one adult male, Seldovia, July 17. Six males from Muller Bay average, wing, 86 mm. The Seldovia specimen, which is somewhat worn, measures, wing, 83 mm., but does not otherwise differ from those from Muller Bay.

It is possible that Kenai Mountain and Homer specimens referred by me to *P. i. annectens* (this Bulletin, XVI, 1902, 243) are *unalaschensis* in fall plumage.

46. *Hirundo erythrogaster*. BARN SWALLOW. — Two adult males, July 2 and 19, one juvenal, July 28, Seldovia.

47. *Ampeils garrulus*. BOHEMIAN WAXWING. — Three adults, October 8.

48. *Lanius borealis*. NORTHERN SHRIKE. — One adult female, Moose Camp, October 1.

49. **Helminthophila celata lutescens.** LUTESCENT WARBLER. — Two adults, Seldovia, July 8 and 14, one juvenal, Sheep Creek, August 8.

50. **Dendroica æstiva rubiginosa.** ALASKAN YELLOW WARBLER. — One specimen, Sheep Creek, August 26.

51. **Dendroica coronata.** MYRTLE WARBLER. — Seldovia, July 3 to 15, two adult males and three adult females; Sheep Creek, August 8 to 26, three juvenals, one adult with nearly complete winter plumage.

These birds evidently represent the *Dendroica coronata hooveri* of Bishop and doubtless also of McGregor. Fully adult males of Alaskan and Eastern birds differ, as Dr. Bishop has pointed out, in the amount of black on the breast, *hooveri* being streaked, *coronata* blotched with black. Adult females and winter specimens of all ages and both sexes present slight *average* differences in color and size, the Alaskan bird averaging somewhat larger (wing, 74 mm.) and less heavily streaked with black. The name *hooveri*, therefore, could be applied with certainty only to fully (that is, two years old or older) adult specimens, leaving in doubt the identity of fully ninety-five per cent. of the specimens of this species ordinarily contained in collections, unless the locality at which they were collected be taken into account; and in many winter specimens this would obviously be of little assistance. Under the circumstances, in this as well as similar cases, it seems eminently desirable to ignore in nomenclature an unquestionable difference rather than to give it a name which we could rarely use with any assurance of correctness.

52. **Dendroica townsendi.** TOWNSEND'S WARBLER. — One juvenal male passing into winter plumage, Seldovia, July 29; one male in first winter plumage, Sheep Creek, August 26.

53. **Seiurus noveboracensis notabilis.** GRINNELL'S WATER-THRUSH. — One adult male, Seldovia, July 4.

54. **Wilsonia pusilla pileolata.** PILEOLATED WARBLER. — Two males, Muller Bay, June 4; six adults, Seldovia, July 8 to 28; two specimens in winter plumage, Sheep Creek, August 11 and 13.

55. **Anthus pensilvanicus.** AMERICAN PIPIT. — Two

males, Herendeen Bay, May 20; one male, two females, Muller Bay, June 11.

Comparison of these specimens with eastern birds in breeding plumage, kindly loaned me by Dr. C. W. Richmond, Assistant Curator of the Department of Birds of the United States National Museum, shows the males to average grayer above and paler below; the females do not differ from those from the Atlantic Coast. The Alaskan birds average slightly smaller in measurements of wing, tail, and bill.

56. ***Certhia familiaris montana***. WESTERN CREEPER. — One female juvenal, Seldovia, July 20.

57. ***Parus atricapillus septentrionalis***. LONG-TAILED CHICKADEE. — Three specimens, August 12 to 21, Sheep Creek.

58. ***Parus atricapillus turneri***. TURNER'S CHICKADEE. — One adult male, Muller Bay, June 4. Readily distinguishable from *septentrionalis* by the absence of a brownish tinge either above or below.

59. ***Parus hudsonicus columbianus***. COLUMBIAN CHICKADEE. — Three adults, three juvenals, Seldovia, July 3 to 28; two in winter plumage, August 19 and October 7, Sheep Creek and Moose Camp. The last named specimens agree with those previously recorded by me from this region (this Bulletin, XVI, 1902, p. 244). The summer specimens from Seldovia, as is usual in this group, are much paler, but in the absence of material for comparison they throw no additional light on the relationships of the Cook Inlet form.

60. ***Hylocichla guttata***. ALASKAN HERMIT THRUSH. — One adult male, Muller Bay, June 1; eighteen adults, June 26 to July 28, two juvenals, July 19 and 28, Seldovia.

61. ***Merula migratoria***. ROBIN. — One juvenal, Sheep Creek, August 30.

62. ***Ixoreus naevius***. VARIED THRUSH. — One adult male and two females, Seldovia, July 3.

**Article XXXV.** — REPORT ON MAMMALS FROM THE  
DISTRICT OF SANTA MARTA, COLOMBIA, COL-  
LECTED BY MR. HERBERT H. SMITH, WITH  
FIELD NOTES BY MR. SMITH.

By J. A. ALLEN.

Mainly through the personal gift of President Morris K. Jesup of the American Museum of Natural History, the Museum has acquired the large collection of mammals and birds<sup>1</sup> made chiefly near the coast in the vicinity of Santa Marta, Colombia, under the direction of Mr. and Mrs. Herbert H. Smith, who, through previous explorations in southern Brazil, the West Indies, and Mexico, had acquired an almost world-wide reputation as expert collectors, particularly in entomology, botany, and ornithology. They took with them several assistants, and also made extensive use of the native hunters in securing the larger mammals. The first shipments reached the Museum towards the end of 1898 and during 1899; a certain number of specimens were selected, according to previous agreement, for the Museum and the others were held in storage. The final shipment reached the Museum late in 1901, and remained in the original packages till the early part of the present year when, together with the duplicates from previous shipments, they were purchased by the Museum, and the whole collection of mammals became for the first time available for examination. Much use, however, had previously been made of the available portions, as shown by the list of publications based thereon given below.

The collecting of mammals and birds formed only a part of the grand scheme of a general natural history survey of the whole Department of Magdalena, planned by Mr. Smith, but which circumstances quite unlooked for rendered impossible to carry out, his long and serious illness in the field being soon followed by a political revolution which rendered work impracticable, the immediate scene of Mr. Smith's labors being

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<sup>1</sup> A set of duplicates was sent, by special arrangement, direct to the Carnegie Museum at Pittsburg, but subsequently most of these came under my observation.

alternately overrun by insurgent and government forces. I am greatly indebted to Mr. Smith for the following account of the physical features of the region, a detailed list of the localities at which collections were made, and for field notes on many of the species. The field notes are distinguished by marks of quotation and the initials H. H. S.

#### DESCRIPTION OF THE REGION.

*By Herbert H. Smith.*

The collection of mammals and birds for the American Museum of Natural History was made during three years and a half, March, 1898, to September, 1901. My original intention had been to explore the whole Department of Magdalena; that is, northern Colombia from the Magdalena River to Venezuela, and extending from the coast over 200 miles inland. Almost in the outset, I was laid up for six months by a severe illness; subsequently my plans were frustrated by a civil war, which made travelling practically impossible. Our work was thus restricted to a comparatively small area in the northwestern corner of the Department. A brief description of this region may be useful and I shall preface it with some general remarks on the mountain region to which it belongs.

The Sierra Nevada de Santa Marta is an isolated mass about midway between Magdalena and the Venezuelan frontier, and within sight of the northern coast. It is nearly 18,000 feet high, and has a very extensive snowfield, stretching probably thirty miles from southwest to northeast. The Sierra Nevada does not belong to the Andean system; westward it is separated from one branch by the broad plains of the Magdalena, and to the east and southeast a long valley divides it from the Black Andes. This valley is drained by the river Cesar, flowing south-southwest to the Magdalena, and the river Rancheria, passing northward to the coast; the sources of these streams are close together, and the pass between them is said to be less than 1000 feet above sea-level. A depression of 1000 feet, therefore, would reduce the Sierra Nevada region to an island, separated from the continent by



a narrow channel on the east and south and a broader one on the west. This almost insular character of the region is important and should be borne in mind. It may be noted that the geological formations of the Sierra, as far as we have any knowledge of them, show no direct relations with those of the Andes. There are no active volcanoes, and no extinct ones are certainly known. Earthquakes are common in the Andean chain and their vibrations are sometimes felt simultaneously from Peru to the Caribbean Islands; but they do not affect the Sierra Nevada. The occasional slight tremors recorded are purely local.

North of the Sierra the Caribbean coast extends nearly east and west; but at Cabo de Aguja, near Santa Marta, it turns southward at a right angle; twenty miles from the point the high coast touches the plain about the great lagoon called La Cienega; beyond this the mountainous lands adjoin the plain along the north and south line. The plain and lagoon are part of the estuary system of the Magdalena.

Our explorations were made mainly within a triangle formed by the coast and the San Lorenzo Mountains. These mountains form a lower chain, trending from west-south-west to east-northeast, and are separated from the Sierra Nevada by a narrow and deep valley; the Horqueta, one of their peaks, is 8400 feet high as measured by my aneroid, and I judge that the San Lorenzo Mountains, which I did not reach, are at least 500 feet higher. To the northwest of the principal range are several lower ridges, roughly parallel to it and abutting diagonally on the northern coast. This portion of the coast is remarkably picturesque, a succession of rocky headlands with deep bays between the ridges; the bays are often backed by sand beaches and mangrove swamps of no great extent. Further east the headlands are no longer seen, and low, rolling lands extend back to the base of the Sierra Nevada.

Numerous streams rise in the San Lorenzo Mountains, flowing down through deep ravines in long series of cascades; as they approach the coast they have wide valleys with more or less alluvial land. The most important of these streams

are the rivers Cordova, Frio, Gaira, Manzanares, Piedras, Buritaca, and Don Diego. The only swamps are those of the Magdalena estuary, some small patches along the lower courses of the rivers, and the mangrove thickets.

With the exceptions noted below the whole region is covered with forest; but there are two strongly contrasted growths, which I distinguish as mountain forest and dry forest. Locally these are called mata and pampa, the latter term, in this region, including dry forest as well as grass lands.

The true mountain forest is a matted growth of trees and vines with numerous epiphytes and ferns; very few trees shed their leaves at stated seasons, and the forest is damp and verdant throughout the year. In the dry forests, on the contrary, nearly all the trees and vines are leafless during the latter part of the dry season, February to May; the few peculiar ferns die down to the roots. Grasses and herbs are abundant wherever the ground is not too shady, but they wither during the dry months. The distinction of plant species is almost complete, and is all the more remarkable because the two kinds of forest exist side by side; during the rainy months an unpractised traveller will hardly note that he is passing from one flora to another; but in March the dry forest is almost leafless, while the other is green and luxuriant.

The extreme summits of the San Lorenzo Mountains are generally without large trees, the low growth consisting of bromelias, ferns, bushes, etc. But with these exceptions the mountain forest covers everything down to a level of about 2000 feet above the sea; below that it extends in narrow lines along the river shores, sometimes to the coast. Further east, near Don Diego, the mountain forest comes down bodily to the seashore or near it.

The dry forest covers most of the remaining country, sometimes with a heavy growth of high trees, sometimes lower and more open; on dry hills near the coast it becomes 'scrub,' seldom over twenty-five feet high, but with little change of plant species. In the river valleys it is generally separated from the water by a thin line of trees like those of

the mountain forest. On ridges and hills, especially in Manzanares valley, the trees often disappear altogether or grow scattered over the open grass lands.

I have been thus explicit in describing the two kinds of forest because they exist in all parts of tropical America, and, in my opinion, the distinction is interesting and significant. The 'pampa' of the Santa Marta district is the 'campo' and 'coatinga' of Brazil, and the scrubby growth of lower hills in the West Indies; a modified form is the 'chapparal' of Mexico. Everywhere the plants are different from those of the swamp forest; generally the trees are lower, often small and gnarled and sometimes scattered; and everywhere they shed their leaves during the dry season. The difference does not always correspond to a difference of soil or situation; the two kinds of forest may adjoin each other on level ground or on a mountain side, on land equally dry or humid.

It is impossible to avoid the impression that the dry forest is an old, stunted, and worn out vegetation, tending to extinction, while the swamp forest, with its exuberant growth, is plant life in the vigor of youth. Such impressions cannot be accepted as scientific truths, yet they may point in the right direction. It appears certain that the swamp forest is gradually encroaching on the other; this can be observed nearly everywhere. It is possible that the dry forest, with its open lands or 'campos,' represents an older flora.

As yet we have no comparative lists of the plants; and until these are drawn up and we know more about the tertiary and quaternary floras of South America we can reach no definite conclusions on the question. As animals pass readily from one kind of forest to the other, it may be impossible to determine their original habitats; yet certain species and groups can be assigned with some confidence. To the dry forest region, for example, belong the deer with branched horns (except *C. palustris* [= *Odocoileus palustris*], which is an inhabitant of the river plains), all the tropical American Canidæ, hare, and all, or nearly all, the armadilloes. The puma and one or two unicolored cats affect the dry forest. The ostrich, common in the interior of Brazil, lives exclusively

on the open lands and can hardly be driven into the forest. It is much more difficult to designate the mammalia of the damp forest, because all of them wander into the dry forest where the trees are high and thick enough; such as the monkeys, the spotted Felidæ, various tree-loving carnivora, such as the kinkajou, sloths, opossums, all the deer with unbranched horns, wild hogs, and tapirs; the herbivorous species sometimes enter the open lands, but generally at night. The great anteater and tamandua seem to wander indifferently in both kinds of forest, but the little tamandua belongs in the damp forest, as does the sloth. Among rodents, pacas and squirrels may be assigned to the damp forest, as may many rats; agoutis seem to live indifferently wherever they have shade and food; capivaras belong to the river-plains. The land-shells and insects of the two kinds of forest are strongly contrasted. Among the latter, for example, *Hypocephalus* inhabits the dry-forest region of Bahia; it is a remarkable beetle combining the characters of many families; Leconte and Horn regard it as an archaic type.

I have already called attention to the semi-insular character of the Sierra Nevada, and this region also includes the San Lorenzo Mountains; with such conditions we may naturally look for some peculiar species. To some extent the collections already made bear out this supposition; certain mammalia, birds, insects, and land-shells are known only from this region. But we cannot speak confidently about them until we have larger collections from adjoining districts, and especially from the Black Andes. It is even possible that some plants may be peculiar to the Santa Marta region. My own large collection of phanerogams and ferns includes several hundred species not previously known. But plants are readily distributed by their seeds, and they are not likely to be limited by narrow valleys; probably most or all of these species will eventually be found in the Black Andes.

Following is a list of the principal localities marked on my labels. Our hunters often made long excursions and we could not tell accurately the altitudes from which specimens were brought; the figures given are approximate only.

1. *Santa Marta*: City in a bay of the same name, north of the Manzanares River; the bay is backed by salt plains and surrounded by dry hills covered with a scrubby growth (dry-forest species). Considerable tracts of the lower lands are irrigated.

2. *Bonda*: Village on the river Manzanares, 7 miles east of Santa Marta. This was our head quarters during the greater part of our stay in Colombia. The village itself is only 150 feet above sea-level, but most collections were made in somewhat higher land. The country is hilly, covered in great part with dry forest with intervals of open grass land in the ridges. A thin line of mountain forest adjoins the river.

3. *Mamatoco*: Village on the Manzanares, 2 miles below Bonda; elevation 100 feet; vegetation as at Bonda, but with more scrubby growth on the hills and some small tracts of swamp. Cantilito is a small plantation between the two villages, adjoining Quebra Mojada, a stream and ravine.

4. *El Libano*: Plantation 1 mile south of Mamatoco; elevation 150 feet. This must not be confounded with the locality of the same name among the mountains.

5. *Masinga*: Valley on the Manzanares, 1 mile above Bonda. Elevation 250 feet; vegetation as at Bonda.

6. *Masinga Vieja*: On the Manzanares, about 4 miles above Bonda, at 600 feet; it is the site of an Indian village, now abandoned. The line of mountain forest along the river has here become broader; the neighboring ridges rise to 1000 feet and are generally open and grassy.

7. *Onaca*: Plantation, 18 miles E. S. E. of Santa Marta, at the lower border of the main mountain forest, which here adjoins the open lands. Elevation 2000 feet.

8. *Jiracasaca*: Plantation near Onaca, and at about the same level.

9. *Las Nubes*: Plantation 3 miles south of Onaca, at 4500 feet; large clearings in the mountain forest. Alto de Cielo is a locality and clearing near it, at 5000 feet.

10. *Don Amo*: Plantation 18 miles east of Santa Marta, in a mountain valley, at 1500 feet; large clearings in mountain forest, with adjoining dry forest and open lands. Don Amo Viejo is a locality near it.

11. *Cacagualito*: Plantation 20 miles east of Santa Marta, 1500 feet; vegetation principally mountain forest, which here extends to a lower level. Jordan is a plantation 2 miles further east, in a valley, at 1000 feet.

12. *Taganga*: Fishing village on a bay of the same name, 2 miles northeast of Santa Marta, surrounded by low mountain ridges; the country is very dry, with a scrubby growth (dry-forest species) and

numerous cacti. The coast is rocky and high, sometimes with surf-washed caves in which bats are abundant. Guairaca, Clinto, and Neguanje are uninhabited localities on the coast further east.

13. *Buritaca*: A river entering the sea about 40 miles east of Santa Marta. The mountain forest here comes down bodily to the coast, where there are sand-beaches and mangrove-swamps; the country is low and damp. There are small tracts of open grass land near the river mouth.

14. *Don Diego*: Plantation on the coast at the mouth of the river Don Diego, five miles east of the Buritaca and with similar surface and vegetation.

15. *Minca*: Plantation on the river Gaira, 12 miles southeast of Santa Marta, at the lower border of the main mountain forest, which here adjoins dry forest and open grass lands. Elevation 2000 feet.

16. *Agua Dulce*: Plantation 2 miles southeast of Minca, at 2400 feet; large clearings in mountain forest.

17. *Valparaiso*: Plantation near the head of the river Gaira, 20 miles southeast of Santa Marta, 4500 feet. Extensive clearings in the mountain forest. Las Purtidas is a locality near it at 3500 feet.

18. *El Libano*, Cerro del Libano, or Sierra del Libano (names used by American planters): This is a locality rather than a mountain, and we camped there for several weeks. The camp was in a valley of the San Lorenzo mountain range, 5 miles southeast of Valparaiso and about 25 miles from Santa Marta; elevation about 5500 feet. The forest here is very dense and luxuriant, only broken by two small clearings; collections were mainly from rocky mountain sides, 5000 to 6500 feet

19. *Cienega*, or *La Cienega*: Town on the coast adjoining the great lagoon of the same name; the lagoon belongs to the estuary system of the Magdalena. The country around is flat, swampy in places, and with salt plains; two or three miles back are dry hills with a scrubby growth (dry-forest vegetation). Rio Frio is a town a few miles south of Cienega, on a river of the same name; Gaira, on the Gaira River, is between Cienega and Santa Marta, on low land. These towns are connected by a railroad.

The mammals forming the basis of the present paper number about 1250 specimens and represent 73 species, of which about 30 appear to be forms peculiar to this region, termed 'semi-insular' by Mr. Smith (*cf. antea*, p. 412). The birds also have yielded a high percentage of peculiar forms, as determined by Mr. Outram Bangs and myself.<sup>1</sup>

<sup>1</sup> A report on the birds of this collection was published in Vol. XIII of this Bulletin (August, 1900, pp. 117-183).

As shown by Mr. Smith's list of localities (*antea*, p. 413) the greater part are near the coast at altitudes ranging from sea-level to about 600 feet; a few are between 1000 and 1500 feet, one at 2000, and three at 4500 to 6000 feet; but probably fully two thirds of the specimens were collected below 1000 feet, only a few weeks out of the three years and a half having been spent by Mr. Smith's collectors at altitudes as high as 4500 feet. These were all in the San Lorenzo Mountains, the Sierra Nevada de Santa Marta not being visited. The area, as indicated for me by Mr. Smith on a map of Colombia, is a triangle of which the west side (length about 25 miles) is formed by Magdalena Bay, the north side (length about 30 miles) by the coast of the Caribbean Sea, the other or inland side (length about 40 miles) forming the hypotenuse of the triangle, the whole district probably not exceeding 600 square miles.

While Mr. Smith was preparing for his exploration of the Santa Marta region of Colombia, it happened that the Messrs. A. E. and O. Bangs of Boston had also been attracted to the same region as one of special interest, and, to the surprise of all the parties interested (*cf.* this Bulletin, XIII, p. 118), when Mr. Smith reached Santa Marta, after preparations for financing the trip and gathering the necessary equipment, he found Mr. W. W. Brown already in the field in the interest of the Messrs. Bangs Brothers. As, however, Mr. Brown proceeded soon to the Sierra Nevada de Santa Marta, working at altitudes and in a region for the most part above the district reached by Mr. Smith, there was little duplication of work. Mr. Brown naturally thus obtained a number of species not represented in the Smith material, which, with some others from the coast region, were very promptly made known by Mr. Bangs. In his final paper on the Santa Marta collection of mammals (Proc. New Engl. Zoöl. Club, I, 1900, pp. 87-102) he records 7 species not contained in the Smith collection, while the latter includes 26 species not in the Brown collection. Some of the larger species obtained by Mr. Brown, as *Felis concolor*, *Felis onca*, *Myrmecophaga tridactyla*, etc., are, however, mentioned in Mr. Smith's field notes, and for this reason are included in the present paper.

As already intimated, the material in the present collection has already served, in part or exclusively, as a basis of a number of previously published papers, and in the present connection it has been deemed sufficient merely to cite these earlier papers instead of repeating their substance. I append here an annotated list of these earlier papers, all of which appeared in this 'Bulletin.'

1899. New Rodents from Colombia and Venezuela. *Bull. Am. Mus. Nat. Hist.*, XII, 1899, pp. 195-218. Dec. 20, 1899.

The new species from Santa Marta are: (1) *Lepus (Sylvilagus) superciliaris* (p. 196); (2) *Isothrix rufodorsalis* (p. 197); (3) *Echimys* (= *Proechimys*) *mincæ* (p. 198); (4) *Echimys* (= *Proechimys*) *canicollis* (p. 200); (5) *Heteromys jesupi* (p. 201); (6) *Akodon columbianus* (p. 203); (7) *Oryzomys maculiventer* (p. 204); (8) *Oryzomys trichurus* (p. 206); (9) *Oryzomys sanctæmartæ* (p. 207); (10) *Oryzomys molli-pilosus* (p. 208); (11) *Oryzomys magdalænæ* (p. 209); (12) *Oryzomys villosus* (p. 210); (13) *Sciurus saltuensis bondæ* (p. 213).

1900. List of Bats Collected by Mr. H. H. Smith, in the Santa Marta Region of Colombia, with Descriptions of New Species. *Ibid.*, XIII, pp. 87-94. May 12, 1900.

Twenty-two species. The new species are (1) *Chiroderma jesupi* (p. 88); (2) *Micronycteris hypoleuca* (p. 90); (3) *Promops affinis* (p. 91).

1900. Descriptions of New American Marsupials. *Ibid.*, XIII, pp. 191-199. Oct. 23, 1900.

The new Santa Marta forms are (1) *Didelphis karkinophaga* (= *marsupialis*) *colombica* (p. 193); (2) *Metachirus nudicaudatus colombianus* (p. 196).

1904. Mammals from Southern Mexico and Central and South America. *Ibid.*, XX, pp. 29-80. February 29, 1904.

One new Santa Marta form, *Tayra barbara irara* (p. 36).

1904. New Bats from Tropical America, with note on species of *Otopterus*. *Ibid.*, XX, pp. 227-237. June 29, 1904.

A new Santa Marta species is *Molossus bondæ* (p. 228).

1904. New Mammals from Venezuela and Colombia. *Ibid.*, XX, pp. 327-335. Oct. 8, 1904.

The new Santa Marta forms are: (1) *Felis sanctæmartæ* (p. 332); (2) *Procyon proteus* (p. 333).

1904. The Tamandua Anteaters. *Ibid.*, XX, pp. 385-398. Oct. 29, 1904.

A new form from Santa Marta is *Tamandua tetradactyla instabilis* (p. 392).



In addition to the 23 new forms enumerated above, three others will be found described in the present paper, while 10 have been described by Mr. Bangs and 1 by Mr. G. H. Miller, Jr., or 37 in all, out of a total of 86 species recorded from the Santa Marta region. It is probable that still others will require new names, since several of the species of *Oryzomys* recorded by Mr. Bangs from the Sierra Nevada de Santa Marta as identical with Merida or Bogota species can hardly be the same, although perhaps representative of them, since continuous distribution is, to say the least, improbable.

As already said in my report on the birds of this region (this Bulletin, XIII, 1900, p. 122), the fauna of the Santa Marta district (including the high Sierra and low-coast region) presents many peculiar forms, a few of them strongly differentiated from their nearest allies in neighboring regions, others their less modified representatives. This is as would be expected from its topographically isolated position, being, as Mr. Smith has expressed it, "semi-insular" in respect to its physical conditions, and has doubtless been long separated, as regards its mountainous areas, from the Andean ranges to the westward and southward. Also, as already said in another connection, "the home of many 'Colombia' species is to be looked for elsewhere than eastern Colombia," as illustrated by the case of Geoffroy's *Sciurus variabilis*, discussed later in the present paper.

#### ANNOTATED LIST.

1. **Marmosa mitis** Bangs. — Fifteen specimens, as follows: Bonda, 2 adult males, March and August; 4 females and 6 young, Aug. 8–Sept. 4; Mamatoco, 1 adult female, June 1; Taganga, 1 adult female, June 25; Minca, 1 adult male, June.

"OPOSSUM RAT. — A small grayish-brown species, found in the forest from sea-level to 4000 feet or higher. It is arboreal and strictly nocturnal, passing the day in hollow trees. The females have about eight young, which, when partly grown, are carried on her back, their prehensile tails twining about the mother's tail as she holds it arched over her body. Opossum rats appear to live mainly on insects and birds' eggs; they prowl about on the branches at night. I once caught November, 1904.]

one as I was nothing near Valparaiso; the animal was dazzled by my lantern and I easily knocked it into my insect net. Near Mamatoco I found one in a hollow tree which it had entered through a hole ten feet above the ground; it was driven out with difficulty and could not see in the daylight.

"They use the tail to balance and steady their bodies while moving about the slender branches. A common position is transversely across the upper side of a branch, the fore feet close together and the tail passing beneath and over the branch; they seldom or never reach upward with the tail."—H. H. S.

2. *Metachirus nudicaudatus colombianus* Allen. — One specimen, adult male, Don Amo, April 20. (See this Bulletin, XIII, 1900, p. 196.)

3. *Caluromys cicur* (Bangs). — One specimen, skull only, Minca.

4. *Didelphis marsupialis colombica* (Allen). — Twenty specimens, all from the vicinity of Bonda, except one from Valparaiso. (See this Bulletin, XIII, 1900, p. 193; XIV, 1901, pp. 176, 186; XVII, 1902, pp. 260, 276.)

"OPOSSUM. — Common in the dry forest and found in the mountain forest as high as 5000 feet. It is nocturnal, though sometimes moving about during the cool hours of the day. It passes the greater part of the time in trees, occasionally descending to the ground. Opossums seem to be very general feeders, eating insects, young birds, eggs, chickens when they can get them, and sometimes fruits. They make their homes in hollow trees, generally high above the ground. In Colombia the flesh is seldom eaten." — H. H. S.

The Water Opossum (*Chironectes minimus*) was taken at Santa Marta — a single specimen — by Mr. Brown (Bangs, Proc. New Engl. Zool. Club, I, 1900, p. 90).

5. *Bradypus tridactylus* Linn. — Not represented in the collection sent to the American Museum, but the skull of the specimen referred to below by Mr. Smith has been kindly loaned to me for examination by Mr. W. E. Clyde Todd, Custodian of Mammals and Birds at the Carnegie Museum. Mr. Todd has also kindly sent me a description of the exter-

nal characters (from the mounted specimen), from which and the skull it evidently belongs to the *B. tridactylus* group.

"SLOTH (called *perico lijero* in sarcastic reference to its movements). — Extremely rare near Santa Marta, though sometimes found on the low lands near the river Manzanares; its low cry, said to resemble the wailing of an infant, is occasionally heard at night. Southward, beyond Rio Frio and in swampy forest adjoining the Magdalena flood plains, it is said to be more common; it does not occur in the mountains. Just before leaving Santa Marta we purchased a living specimen which had been brought from Rio Frio; we succeeded in carrying this to Pittsburgh, where it soon died. The skin and skeleton are now in the Carnegie Museum in that city. While living the animal would eat little except mangoes and bananas, which it seemed to like; it spent most of the time clinging to the back of a chair or to slats on its box; on the ground it could move only by stretching out one long fore-leg, hooking an object with its claw, and drawing its body up. Yet sloths sometimes descend to the ground in passing from tree to tree; I once found one between two trees in the forest near Santarem.

"The natural position of a sloth while feeding is either reversed, hanging from a branch by its claws, or clinging to a perpendicular branch with its head upward; in descending it goes backward. Its movements are very leisurely, but by no means as slow as they have been described.

"Sloths are very tenacious of life; I have known one to be literally riddled with seven or eight charges of shot before it loosened its hold and fell." — H. H. S.

6. *Myrmecophaga tridactyla* (Linn.). — Not represented by specimens. A single example was obtained at Dibulla by Mr. Brown (Bangs, Proc. N. Engl. Zool. Club, I, p. 89). Following are Mr. Smith's notes on its occurrence in the district.

"GREAT ANTEATER. — This animal is extremely rare in the Santa Marta mountains, though occasionally reported; the only one we heard of during our stay was seen by my son and two porters as they were passing on a mountain pass near Valparaiso, at an elevation of about 5000 feet; they had no

firearms, and as none of the party had ever seen the animal before, they hesitated to attack it with sticks; it moved down the mountain side and disappeared in the forest.

"From the notes gathered in Brazil, it appears that the great anteater is essentially a forest animal, though sometimes coming out to the open lands; it eats insects and insect larvæ of many kinds and, I believe, small fruits. The flesh is rarely eaten, and only in case of necessity." — H. H. S.

7. *Tamandua tetradactyla instabilis* Allen. — Fifty-seven specimens, all taken at or near Bonda. There are 6 skeletons, the rest being skins and skulls. Only two or three are positively marked for sex, but about half have external measurements, consisting of total length and length of tail. (For measurements and description see this Bulletin, XX, 1904, pp. 386-397.)

"TAMANDUA (called *soro-chuchu*). — Quite common, principally below 2000 feet, in the dry forest. It is very variable in color, but only one species is recognized by the hunters. Like the great anteater, the tamandua is essentially a forest animal, and terrestrial, rarely if ever ascending trees, though its long, hooked claws would seem to fit it well for climbing. It walks slowly and awkwardly on the sides of its feet, and is easily killed by a slight blow on the head. The animal would soon be exterminated if it were much hunted, but the meat is worthless and the skin is but little prized. Tamanduas eat termites, ant larvæ, various other insects, and certain small fruits.

"The little anteater [*Cyclopes didactylus*] is not found in the Santa Marta district; at least, none of our hunters had ever heard of it." — H. H. S.

8. *Tatu novemcinctus* (Linn.). — Four specimens, 1 adult and 3 very small young ones, from Bonda (2), Don Amo, and Valparaiso. Adult, total length, 711; tail, 356.

"ARMADILLOES. — A species [*Tatu novemcinctus*] is found, rarely, in the dry forest and in the open land below 2000 feet; and we obtained a single specimen of another [*Cabassous lugubris*] on an open mountain ridge above Valparaiso, at about 5000 feet.

"Armadilloes vary much in their habits and habitat, but

nearly all are found in dry forest or on open land, though wandering into the forest, where, perhaps, some species are residents; they make deep burrows, and, when alarmed, commonly dig into the ground, disappearing rapidly; if the hinder part of the body or the tail is seized before they have quite buried themselves, it is difficult to drag the animal out, so strong is the hold of their hooked claws. They make amusing pets, but are apt to be a nuisance in country houses without floors; they burrow anywhere and make exits under the walls. In captivity the smaller kinds readily eat fruit and rice; in a wild state, all or nearly all the species are partly insectivorous, and some kinds habitually burrow into termite-hills; some eat fruits, and one or two of the larger heavily armored kinds are not averse to carrion.

"The large species are never eaten. Some of the smaller kinds, especially those capable of rolling themselves into balls, are greatly esteemed as food. On the Amazon the Indians roast them in their own shells." — H. H. S.

#### 9. *Cabassous (Ziphila) lugubris* (Gray).

*Tatoua (Ziphila) lugubris* MILLER, Proc. Biol. Soc. Wash., XIII, Jan. 31, 1899, 6, 8, (Santa Marta).

*Cabassous hispidus* BANGS, Proc. N. Engl. Zool. Club, I, Feb. 23, 1900, 89 (Santa Marta).

Three specimens, carapaces with skeletons, all adult males, — two from Bonda and one from Valparaiso.

The collector's measurements of two of the specimens (Nos. 14862 and 23441, Bonda) are as follows: Total length, 533, 495; tail, 159, 140; ear, 45, 62.

The skulls measure as follows:

	14862	14863	23441
	♂	♂ ?	♂
Greatest length.....	76.5	72	74
Basal length.....	70	65.5	66.5
Zygomatic breadth.....	39	39	38.5
Mastoid breadth.....	37	36	34
Interorbital breadth.....	24	25	24
Depth of occiput.....	27	27	26
Length of nasals.....	25.5	23	24
Palatal length.....	46	43	43
Length of mandible.....	56	55	56.5
Upper toothrow.....	30	28	28
Lower toothrow.....	25	26	26

Through the kindness of Mr. Witmer Stone, I have been able to compare two of the Cope series of specimens of *Cabassous hispidus*, now in the Museum of the Philadelphia Academy of Natural Sciences, and also an additional skull in this Museum, from Chapada, Matto Grosso, Brazil, with the present series. The Philadelphia Academy specimens are the specimens used by Mr. Gerrit S. Miller, Jr., in the preparation of his paper entitled 'Notes on the Naked-tailed Armadillos' (Proc. Biol. Soc. Wash., XIII, pp. 1-8, figs. 1, 2, Jan. 31, 1899). A critical comparison of this material leads me to accept Mr. Miller's conclusions as against those of Mr. Bangs — namely, that the Santa Marta form is not only specifically but subgenerically separable from *C. hispidus*. Externally the Santa Marta form closely agrees with the Central American *C. centralis* (Miller), but differs greatly in the form of the skull. The differences in the form and number of plates in the head shield, the size and form of the ears, the absence or presence of minute bony plates on the posterior surface of the ears, are among the obvious distinctions between the *C. hispidus* and the *Ziphipha* groups, as already made clear by Mr. Miller. The comparatively naked ventral surface and the almost entire absence of bristles at the posterior edges of the plates of the carapace (except on the lower lateral rows) is another feature of contrast between *C. hispidus* and the *Ziphipha* group.

It is not, however, so clear that the Santa Marta animal should take the name *lugubris*, the type locality of which is "St. Catherines, Brazils." In the absence of specimens of true *C. lugubris*, however, for comparison, this name is here provisionally accepted, although the presumption is, on geographical grounds, that the Santa Marta animal is different from true *lugubris* from southern Brazil.

The normal dental formula in the *Ziphipha* group appears to be  $\frac{9}{8} - \frac{9}{8} = \frac{18}{16}$ ; but in two specimens out of three in *lugubris* there is an extra tooth in the right upper toothrow, as follows:

No.	14862,	dental formula,	left side,	$\frac{9}{8}$ ;	right side,	$\frac{10}{8}$ .
"	14863,	"	"	"	"	$\frac{10}{8}$ .
"	23441,	"	"	"	"	$\frac{9}{8}$ .

This extra tooth is small, and stands at the front end of the toothrow. In a specimen of *C. hispidus* there is also an extra upper tooth on the right side, but in this case it is a small tooth at the posterior end of the toothrow.

10. *Trichechus manatus* Linn. — Although not represented in the collection the following is of interest.

"MANATEE. — Found along the coast, especially about the mouths of the rivers Buritaca and Don Diego, and other rivers further east; when the waters are high they enter these streams to feed on the grass. In August and September, when the sea is generally calm, parties of fishermen go down from Santa Marta and Taganga to fish for manatee; the animals are harpooned from large canoes. In September, 1899, we made a trip to the Buritaca on purpose to get manatee; but the object was frustrated by unusually heavy winds and high seas, making fishing impossible. Several of the animals were seen as they came to the surface, a quarter-mile from the beach. The manatee seems to be purely herbivorous in its diet, eating grass, and perhaps algæ. Its flesh is much esteemed." — H. H. S.

12. *Tagassu torvum* (Bangs). — Thirty-five specimens, as follows: 12 skins with skulls; 3 skins with skeletons; 2 skins without skulls; 13 skulls without skins; 4 skeletons without skins. About 20 were taken at Naranja, 6 at Bonda, 3 at Quebra Mojada, and others (mostly without data) at these or neighboring localities. The greater part were taken in January and July; others in March, August, October, and December. They are all adult except two half-grown young. Unfortunately the sex of the specimens is not indicated, nor were external measurements taken, the specimens having been killed and skinned by native hunters.

In describing this species (from a single adult male), Mr. Bangs gave no account of its external characters, beyond saying: "Size smaller than in either *T. tajacu* of southern Brazil or *T. angulatus* of Texas. Color and external characters as in these two species." The present large series, however, on comparison with some thirty or more specimens of the *angulatum* group from Mexico and the southern border

of the United States, shows that the coloration in the two groups is strikingly different. The absence of skins from southern Brazil prevents comparison of the external characters of *torvum* with those of *tajacu*, as now restricted, but below will be found a comparison of their cranial characters.

In general effect the color of *T. torvum* is a grizzle of ochraceous buff, white, and black, the mid-dorsal region being black and white with a tinge of buff, becoming yellowish gray finely varied with black on the sides, and strong yellowish buff on the ventral surface and inner surface of the limbs, slightly punctated with brownish black. Black prevails on the median dorsal area, forming a more or less well defined vertebral black stripe, with part of the bristles wholly black and part black barred with white, the black being most developed on the crown, nape, and shoulders, and more mixed with white posteriorly. The hairs individually, except near the median line, are ringed with alternate bands of black and fulvous white, about two of each to each bristle. The fulvous tint forms merely an indistinct border to the white bars. The tips of the bristles are usually black but a part are tipped with yellowish white. The head, except a median blackish face stripe, is usually much more strongly suffused with yellowish buff than the body, particularly on the sides of the face and between the eyes and the base of the ears, this strong buffiness or rusty yellow cast of the head, in contrast with the middle region of the back, being a conspicuous feature of the species as compared with any of its northern allies. The strongly marked ochraceous buff collar is another prominent and very constant feature, formed by the two shoulder bands, which begin on the throat and extend posteriorly and upward, nearly meeting over the shoulders. Feet and anterior surface of limbs blackish brown; chin blackish, and a median blackish band on the face.

Unfortunately, as already stated above, there are practically no external measurements, the specimens having been taken by native hunters and skinned without being measured or any record being made of the sex. The total length is given for two adults as, respectively, 914 and 927 mm.



Taking the skulls as a basis for comparison, *T. torvum* and *T. tajacu* do not differ appreciably in size, as shown by the subjoined tables of measurements, but they are readily separable on other cranial characters, notably by the difference in the facial angle, through the greater depth of the occipital portion of the skull. With the total length and zygomatic breadth absolutely the same (in the average) in both, the depth of the occiput (top of the occipital crest on the median line to lower border of occiput) in *T. tajacu* is 80 mm. and in *T. torvum* 74.5 mm. This gives, approximately, a facial angle of 55° for *tajacu* and a facial angle of 64° for *torvum*. In addition to this, the audital bullæ are slightly larger and the dentition is appreciably weaker in *tajacu* than in *torvum*, as shown in the subjoined tables. On the other hand, *T. torvum* is much like the northern forms of the genus (*angulatum* and allies), but the skull is very much smaller, and, as already shown, the coloration is distinctly different.

The type locality of *T. tajacu* being Paraguay, the Chapada (Matto Grosso, Brazil) series of skulls here used as representing that species is presumably typical, Chapada being close to the northern border of Paraguay. They were collected by Mr. Herbert H. Smith in 1885. All the skulls in both tables are fully adult, but the teeth in some of the Chapada specimens are a little more worn than they are in any of the specimens of the Santa Marta series. None of them has the sex indicated.

One of the specimens of the Chapada series (No. 326) presents an interesting dental abnormality, namely, a supernumerary molar on the right side of the palate, situated opposite the junction of  $m^2$  and  $m^3$ , wholly internal to the toothline. It has the crown structure of  $p^1$ , but is larger, about equalling  $p^2$ .

MEASUREMENTS <sup>1</sup> OF 8 SKULLS OF *Tagassu torvum*, FROM  
SANTA MARTA, COLOMBIA.

Mus. No.	Total length.	Basal length.	Zygom. breadth.	Postorb. breadth.	Depth of occiput.	Upper toothrow.	M <sup>2</sup> .	Rostrum.	Middle upper incisors.	Bulla.
14676	228	193	99	74	73	65	13. x 13.	25	17.5	25 x 23
14677	239	201	102	75	78	68	13.3 x 13	27.5	20	26.6 x 23
14679	206	175	97	69	72.5	63	13.5 x 12.3	25.5	18	21 x 22.5
14681	223	184	—	67	75	65.5	14 x 12	26	18	20.5 x 20
14875	224	186	93	63	74	69	13.5 x 13	26	19	20 x 19
23527	236	197	101	78.5	76.5	66	13.3 x 14	28	19	22 x 23
23529	231.5	195	96	73	76	65.5	13 x 12.3	26.3	19	23 x 22
23532	220	183	102	73	71	66.2	14 x 13	25	17	23 x 20
Average...	226	189	98.7	71.6	74.5	66.3	13.5 x 12.6	26	18.4	22.6 x 21.6

MEASUREMENTS <sup>1</sup> OF 10 SKULLS OF *Tagassu tajacu*, FROM  
CHAPADA, BRAZIL.

Mus. No.	Total length.	Basal length.	Zygom. breadth.	Postorb. breadth.	Depth of occiput.	Upper toothrow.	M <sup>2</sup> .	Rostrum.	Middle upper incisors.	Bulla.
322	231	190	101	70.5	85	65	14 x 11.5	26.5	18.5	23 x 22
323	233	188	98	72	73	60	12 x 11	26	16.6	24 x 21.5
324	230	187.5	98	72	80	62.3	12.5 x 11.5	27.5	19.6	24 x 20
325	220	189.5	98	66	76	58	11 x 11.3	24	18	24 x 20.5
326	218	177	96.5	67.5	81	61	12 x 11	27	17.3	22 x 20
327	226	186.5	93	64	78.3	63.5	13.5 x 13	25.5	18	24 x 22.3
328	222	182	96	72	81	56	10.5 x 11	26.5	16.5	22 x 21
329	223	183	100	71	84	59	12 x 12	26.3	17.5	23.5 x 22
330	233	197	104	70.5	83	65	13 x 12	26	19	22 x 23.5
386	227	188.5	104	74	81	64	13 x 13	27	19	24 x 21
Average	226	187	98.8	70	80	62.4	12.4 x 11.7	26	18	23.3 x 21.4

<sup>1</sup> Explanation of Measurements.

Total length = front edge of premaxillaries to edge of occipital crest.

Basal length = inner base of incisors on the midline to posterior border of condyles.

Zygomatic breadth = at most expanded part of zygomatic arch.

Postorbital processes = between extreme external points.

Depth of occiput = top of occipital crest on median line to lower posterior border of basioccipital.

Rostrum = width in front of canines.

M<sup>2</sup> = length of crown on median line x greatest breadth of tooth.

Middle upper incisors = transverse breadth of alveolar line.

Bulla = greatest length x greatest width

13. *Tagassu (Olidosus) pecari* (Fisher). — Twenty-six specimens, as follows: skins with skulls, 15; skin with skeleton, 1; skins without skulls, 8; skeletons without skins, 2; skulls without skins, 6. Three were taken at Calavasa, the others at Naranja; 7 were collected in January, 4 in March, 3 in July, 3 in August, 2 in October, 1 in December, and 5 are without date.

All are adult except 5; these include four young a few days old and one young about one fourth grown. Only three have the sex indicated, and two only have external measurements, as follows:

Females, Nos. 14871 and 14872, total length, for each, "3 ft. 7 in." (992 mm.).

MEASUREMENTS<sup>1</sup> OF 9 SKULLS OF *Tagassu pecari* FROM  
SANTA MARTA, COLOMBIA.

Mus. No.	Sex.	Total length.	Basal length.	Zygom. breadth.	Postorb. breadth.	Depth of occiput.	Upper toothrow.	M <sup>2</sup> .	Rostrum.	Middle upper incisors.
15464		268	230	112.5	87	89	78	15 X 13	37.5	20.
14874	♀	270	230	116	96	98	78.5	17 X 14	37.5	23
14684		274	235	117	90	97.5	77	15.5 X 14	38	22
14686		259	225	111	87	91	75	16 X 14.6	36	22
14872	♀	267	223	104	87	92	73	15 X 13.5	36.5	22
14688		267	234	115	91	91	75	15 X 13.3	37.5	21
14683		252	214	109	88.5	86	74.5	16 X 13	36	23
15465	♂	268	228	110	87.5	90	90	16 X 14	35.5	22
14687		267	225	105	85	88	74.5	15 X 13	35	21
Average....		260	227	111	88.7	91	77	15.6 X 13.6	36.6	21.8

In the absence of specimens of *Olidosus* from other localities no comparison can be made between the present and allied forms.

The adults of the present series are black, more or less varied with rufous, the amount of rufous varying in different specimens. On the body the hairs are mainly wholly black, mixed with others ringed or tipped with rufous; on the sides of the head the rufous is generally a conspicuous feature of

<sup>1</sup> For explanation of measurements see p. 426. Measurements of the auditory bulla are omitted, since the length cannot be given, the posterior part of the bulla being concealed by the overlying exoccipital.

the coloration, and is more or less prominent on the neck and shoulders. The nose, chin, and throat are soiled whitish, the white extending back as a broad band along the sides of the mouth and on the sides of the neck as far as the ear.

The newly-born young are rufous, with a median dorsal black stripe, from the occiput to the hips. The rufous of the head and body is more or less varied with black, the individual hairs being in part wholly rufous and in part rufous ringed or tipped with black. The nose, chin, and sides of the face are uniform rufous, like the body, showing none of the whitish tint that has given to the adults the name White-lipped Peccary. The rufous of the young in first pelage is gradually replaced when the animal is about one fourth grown by the black pelage of the adult.

One of the most striking peculiarities of the subgenus *Oli-dosus* appears hitherto to have escaped notice, namely, the form and position of the audital bulla. In the subgenus *Tagassu* the bulla is fully exposed posteriorly, and is sub-triangular in outline, with a sharply convex antero-internal angle, a slightly convex internal border, a short obliquely truncated outer angle, and a broad oblique posterior face, abruptly prolonged internally to form a swollen projection, leaving a deeply concave surface on the posterior plane. In *Oli-dosus* the posterior conical projection is greatly produced, and the postero-external third (nearly one half in old specimens) is covered and concealed by the downward projection of the exoccipital, producing a very different outline for the exposed portion of the bulla, which is greatly more extended posteriorly.

"WILD HOGS. — The two species distinguished here as *puerco* [*Tagassu pecari*] and *saina* [*Tagassu torvus*] are both common, especially in the dry forest near the coast; they range certainly to 4000 feet, and probably higher. Puercos go singly or (usually) in pairs, or the sow with her pigs; the saines commonly go in bands of four to ten. Both are eaten, but the meat is unpleasant unless the scent gland is cut out immediately after death. They are commonly hunted with dogs and are often dangerous game, especially the saines when the bands are large. They wander both by day and night,

often seeking streams and pools where they can wallow. Their food consists largely of forest fruits, but they are as omnivorous as domestic swine, eating roots, grubs, fish thrown up on the beach, and so on.

"The saina sows have four, six, or more pigs in a litter; the puercos seldom more than three or four. We tried vainly to rear the young; they were readily tamed, but soon died, no doubt because of the changed diet.

"Both the saina and puerco are much infested with the larva of a fly (*Cestridæ*, called *gusano* here) which burrows under the skin and causes running sores. These larvæ also attack monkeys, dogs, and other animals, as well as man." —H. H. S.

14. **Mazama memorivaga** *F. Cuvier*. — Twenty-one specimens (skins and skulls), and several additional skeletons, as follows: 6 adult males, 12 adult females, 2 half-grown females, and 1 fawn in spotted coat; all taken in the immediate vicinity of Bonda, as follows: Jan. 12 and 13, Feb. 10, March 5, 23, and 28, April 21, June 21 and 22, July 6, Oct. 12 and 13, and Dec. 20. Only six have external measurements, and these give only the total length, the length of the tail, and the girth of the chest and neck. While girth measurements are useful to the taxidermist as an aid in mounting specimens, they are hardly citable in the present connection.

The total length for 3 males is given as: 1118, 1146, 1154; length of tail for the two last, 86, 89. The measurements given for a single female are: Total length, 1168; tail, 127.

Five adult male skulls and 7 adult female skulls measure as follows:

14643, ♂,	gr. length,	185;	gr. breadth, <sup>1</sup>	82;	up. toothrow,	57;	antler,	95.
14640, ♂,	"	184;	"	81;	"	60;	"	109.
14685, ♂,	"	182;	"	83;	"	57;	"	83.
14645, ♂, <sup>2</sup>	"	180;	"	81;	"	55;	"	58.
24378, ♂,	"	178;	"	85;	"	55;	"	113.
14642, ♀,	"	186;	"	81;	"	58.		
15486, ♀,	"	179;	"	80;	"	58.		
14864, ♀,	"	178;	"	78;	"	55.5.		
14646, ♀,	"	175;	"	75;	"	53.5.		
14638, ♀,	"	174;	"	80;	"	56.		
23476, ♀,	"	179;	"	75;	"	57.		
23479, ♀,	"	179;	"	81;	"	56.		

<sup>1</sup> At lower edge of orbits; the zygomatic breadth is 2 to 4 mm. less.

<sup>2</sup> The oldest and also the smallest of the series of males.

The tarsal gland and tuft are present in all the specimens of this series, but they are much smaller than in *M. rufa*, the erect stiff hairs of the tuft proper covering an area of about 12 by 16 mm.; the hairs are very stiff and short, dark brown, with often a small central whitish spot. In *M. rufa* the area covered by the tuft is very much larger — about 25 by 25 — and the hairs are softer, longer, and light yellowish brown.

The present series, although consisting of specimens taken in nearly every month of the year, shows little color variation that can be attributed to season. February, June, and October specimens differ very little in coloration, or in the fulness or length of the pelage. There is, however, considerable individual variation, two specimens (one taken April 21 and the other Oct. 12), being much lighter colored than the others. These have the general color yellowish rufous, the yellowish tips of the hairs being much longer and brighter yellow than usual. The cap of long hairs on the head is in some specimens dark brown, in others dark yellowish rufous.

"This species ranges from sea-level to 4000 or 5000 feet, living properly in the forest, but coming out to graze on the open lands at night. It is not very common in the district explored. These deer are not gregarious, but go singly or in pairs, or the female with her fawn. They are rather nocturnal than diurnal, though they see well enough during the day in the forest shades." — H. H. S.

15. **Tapirus terrestris** (*Linn.*). — Three specimens, two adults, with skeletons, and one in the immature spotted dress, Cacagualito.

"The tapir is common from the sea-coast to 6000 feet, and probably higher, as I have seen tapir tracks at nearly 8000 feet. They go singly or in pairs or families, wandering both during the day and at night, and often seeking streams, where they love to bathe themselves in the cool water; they are said to swim well. The food consists of leaves, young twigs, grass, and fruits. They are properly forest animals, rarely coming out to the open lands at night. In passing through thickets they make their way by sheer strength, breaking or bending the branches; and they can often be tracked by the

noise made; though such heavy animals they can run rapidly even where the growth is tangled. Tapirs see badly, at least during the day, but they are very keen-scented.

"The female tapir has, generally at least, only one young at a birth. The animals are much hunted for their meat, which is excellent, much like beef. In southern Brazil and Argentina the hide is greatly prized for lariats, halters, and other works requiring great strength; it is thick, white, and very strong, and competent judges pronounce it almost equal to hippopotamus hide. In Colombia little use is made of it. As tapirs are easily domesticated, and will feed about a house like swine, it would probably pay well to breed them.

"All the hunters near Santa Marta aver that there is a tapir, found in the mountain forest, which, in general color, resembles *T. americanus*, but has a broad white mark over the shoulders. This information was given without any leading questions, and the hunters knew nothing about the Malay tapir, which by their description this one resembles. . . . I can hardly refuse to believe these reiterated and sober statements, made by my men who had no motive for inventing the story, and who would be incapable of inventing a new species so much like the eastern form. I offered a large reward for a specimen, but failed to obtain one, and can only give the story as I heard it. It seems probable that this region has an undescribed tapir, which differs in color from all the known American species, and resembles that of the Malay Islands."

— H. H. S.

16. *Sciurus saltuensis* (Bangs).

*Sciurus variabilis saltuensis* BANGS, Proc. Biol. Soc. Washington, XI, 1898, 185. Nov. 16, 1898. Pueblo Viejo, Colombia (alt. 8000 ft.)

Six specimens: Valparaiso, 4, May 24–31 and June 13; Sierra El Libano, 1, May 24; Don Diego, 1, May 8. Four of these are very dark, quite unlike the coast form (*S. saltuensis bondæ*), and seem to typically represent the mountain form named *saltuensis* by Mr. Bangs. The fifth specimen is quite like examples in corresponding pelage from the coast region.

"Common, ranging from sea-level to 6000 feet or higher.

As shown by Dr. Allen [this Bulletin, XII, 1899, pp. 214-216], the color of the upper parts varies from red, more or less bright, to dark olivaceous; he considers the former a breeding and the latter a summer or post-breeding pelage. My strong impression, however, is that the depth of coloring is connected in some way with the habitat. We observed that specimens shot near sea-level [*Sciurus saltuensis bondæ*] were generally red, no matter in what month they were found; while those from the mountains [*Sciurus saltuensis*] were commonly dark at all seasons; the rule, however, is not invariable, as we have some dark ones from near the coast and a few bright red ones from the higher mountains. At Minca (2000 feet) the two varieties were about equally common in May. It may be well to note that our first collections were from Bonda, and nearly all the squirrels were red; as dark ones were brought in we noted the difference and always saved such specimens if we could, while often rejecting the red ones. Consequently the collection does not give a correct idea of their relative abundance." — H. H. S.

17. *Sciurus saltuensis bondæ* Allen. — Sixty specimens, including large series of adults of both sexes, and a number of young specimens of various ages, all collected at Bonda except two, taken at Minca. More than half were collected in July, and most of the others late in June or early in August, the months from November to May being represented by only from 1 to 3 specimens each. Many of the specimens are in moult, and the gradual change of pelage can readily be traced.

This squirrel, like many others, is subject to a wide range of seasonal variation in color. In all specimens the ventral surface is pure white, the white extending forward to the posterior border of the throat, and down the inside of the limbs as a narrow band — on the fore limbs ending about half way between elbow and wrist; on the hind limbs, about half way between knee and heel. The rest of the pelage varies from intense bright rufous to olivaceous, except the tail, which is always deep red, the basal portion excepted, which latter varies in color with the season, like the rest of the dorsal pelage. The brilliant rufous phase is evidently the



'winter' or breeding pelage, in which the hairs are long, shining intense uniform rufous, without annulations of black, shown in perfection by only about one specimen in ten of the present series. The olivaceous phase is the opposite extreme, the post-breeding pelage, shown in perfection by still fewer examples. In this pelage the whole dorsal area, including the head, flanks, feet, and the basal inch and a half to two inches of the tail,—all of the body pelage except the fulvous chin and throat and the white of the belly and inside of the limbs and the apical three-fourths to four-fifths of the tail,—is olivaceous, the hairs individually being dark plumbeous for the basal third, then fulvous narrowly ringed subapically with black, giving an olivaceous general effect. The change, as usual, begins on the feet, soon involving the inside of the fore arms and inside of the thighs, and later the whole of the fore limbs and outside of the shoulders; simultaneously there is also developed a bright rufous lateral line; the new pelage now rapidly advances up the sides of the chest and shoulders, meeting on the median line and then extending forward over the head and backward to the base of the tail, the rump, basal portion of the tail, and the top of the head being the parts last to acquire the brilliant rufous of the breeding pelage. The greater part of the specimens of the present series (taken at various dates from June 20 to August 3, but nearly all in July) are in various stages of the change, often showing a clear and unmistakable line of demarkation between the two pelages. The most olivaceous specimen of the series was taken March 12; the most intensely and uniformly rufous specimens were taken July 4, 6, and 29. The seasonal change in color, through moult, is perfectly parallel to that in the North American *Sciurus hudsonicus* group.

There is evidently considerable individual variation, and it seems probable that many specimens never reach the complete intense stage of rufous, but have the hairs of the head, lower back, rump, and the base of the tail red, subapically ringed narrowly with black, the black annulations being more or less visible as a part of the surface color. The tail hairs are generally uniform deep red from tip to base, but in quite

a number of specimens many of them show a distinct band of black, more especially on the apical third of the tail, where there is sometimes developed a rather prominent narrow zone of black, distinctly visible on the lower side of the tail without parting the hairs. There is much reason to suppose, however, that the presence or absence of black in the tail is a seasonal feature, and that the wholly red tails go with the red body pelage and the mixed black and red tails with the olivaceous post-breeding dress.

The first pelage of the young is of the olivaceous annulated type, with, however, the general effect more rufous, and the tail hairs wholly red. Most of the young (about quarter-grown) specimens were taken the last of June and during the first week of July, but one is labelled Nov. 18, showing that the season of reproduction, and also of moult, is subject to much individual variation. (For measurements, and further remarks on seasonal changes and individual variation, — here somewhat modified by more detailed study of a greater amount of material, — see the original description of the subspecies, this Bulletin, XII, 1899, pp. 213-217.)

Mr. Bangs (Proc. Biol. Soc. Wash., XII, 1898, p. 183; Proc. New Eng. Zool. Club, I, 1900, p. 91) has considered the squirrels "from the lowlands of the Colombian coast as strictly typical *Sciurus variabilis*," a conclusion to which I have already taken exception (this Bulletin, XII, 1899, p. 216). At the time we both wrote it was presumed that the type region of this species was Colombia, on the principle of exclusion; but Mr. Bangs assumed the Santa Marta region to be the type locality, while the non-agreement of Geoffroy's description and colored figure with the Santa Marta series led me to believe that the real type locality of *S. variabilis* must have been somewhere in the western part of Colombia. On going over the subject again I still find it impossible to make Geoffroy's description and figure fit the Santa Marta animal. His figure shows a squirrel with the posterior fourth of the dorsal surface deep rufous, in strong contrast with the more anterior part of the dorsal region, and the basal two-thirds of the tail mainly black, a condition in both

respects entirely at variance with any of the phases of the Santa Marta squirrel. His description applies in a general way very well to some phases of the body pelage of this animal. But his account of the tail, the hairs of which, he says, are always black at their origin and red at their extremity, and that the tail, owing to the distichous arrangement of the hairs, is much blacker on the posterior face than on the anterior,<sup>1</sup> is entirely opposed to anything seen in the Santa Marta animal. Besides, there is evidence that M. Plée's journey in Colombia was up the Magdalena River. Schlegel says, in his '*Simiæ*' (Mus. Pays Bas, VII, p. 184), under *Ateles hybridus*: "On sait, par les observations du voyageur Roulin . . . que ce singe est très commun dans la vallée du fleuve Madelaine en Colombie. Les individus du Musée de Paris proviennent, à l'exception d'un seul, du voyage de Plée. Un des nôtres a également été recueilli par ce voyageur." And in his list of specimens of this species he says: "1. Femelle à l'âge moyen, voyage de Plée, Colombie, acquise en 1834 du Musée de Paris." It is probable — perhaps almost certain — that the squirrels, collected by M. Plée, on which Geoffroy founded his *Sciurus variabilis*, came also from the Magdalena River in Central Colombia, — a very different region zoologically from the Santa Marta coast district, and hence the squirrel named *variabilis* would naturally differ from the Santa Marta form. Indeed, it seems now safe to assume that the real type locality of *S. variabilis* is the Magdalena River of Colombia, at some point quite remote from the coast, in the region inhabited by *Ateles hybridus*, which we know is not found in the Santa Marta region.

18. *Mus alexandrinus* Geoffroy. — Five specimens, Onaca, Sept. 2, and El Libano (alt. 6500 feet), June 29 and July 1. Three out of the five specimens are more or less mixed with the *Mus rattus* stock, only one being a normal *M. alexandrinus*.

19. *Mus musculus* Linn. — Three specimens, Taguaga,

<sup>1</sup> "La même remarque est applicable aux longs poils de la queue toujours noirs à leur origine et roux à leur extrémité. Mais il résulte de la disposition distique de la queue qu'elle est toujours beaucoup plus noire à la face postérieure qu'à l'antérieure." — Is. Geoffroy, Mag. de Zool., 1832, Classe I, pl. 4, 5, 6, [p. 3].

June 23 and 24. These are rather more fulvous, both above and below, than average specimens from the United States.

"HOUSE RATS. — Apparently the only common species is the roof rat; this is abundant in all the settlements and is sure to invade new clearings soon after they are started; it was often trapped in old clearings half a mile or more from houses. The only other species we heard of is the house mouse which occurs at Santa Marta, but it is not abundant."—H. H. S.

20. *Oryzomys maculiventer* Allen. — Fifty-two specimens, skins and skulls, and 10 skeletons and skulls, mainly from El Libano and Valparaiso. (See this Bulletin, XII, 1899, p. 204.)

Since this species was first described I have had the opportunity to make direct comparison of a series of specimens of it with *O. meridensis* Thomas, to which *O. maculiventer* has been referred by Mr. Bangs, and find no difficulty in distinguishing the two forms. Though closely allied, they are easily separable.

"This is the commonest species in the San Lorenzo Mountains, from about 4000 to 6000 feet. We found their holes commonly in rocky places, in crevices of the stone; sometimes under stumps or logs." — H. H. S.

21. *Oryzomys illectus* (Bangs). One specimen, adult, Don Diego, May 9.

This species was considered by Mr. Bangs to be a subspecies of *O. flavicans* Thomas, from Merida, Venezuela. With a large series of topotypes of *O. flavicans* before me, I have no hesitation in considering the two forms as specifically distinct, especially as it is highly improbable that their ranges can be continuous.

22. *Oryzomys (Zygodontomys) sanctæmartæ* Allen. — Eight specimens, Mamatoca, and vicinity. (See this Bulletin, XII, 1899, p. 207).

23. *Oryzomys magdalenæ* Allen. — Two specimens, Minca and Valparaiso. (See this Bulletin, XII, 1899, p. 209.)

24. *Oryzomys villosus* Allen. — Two specimens, Valparaiso and Don Diego. (See this Bulletin, XII, 1899, p. 210.)

25. **Oryzomys mollipilosus** Allen. — Eleven specimens, of which only 5 are adult, collected as follows: Valparaiso, 6, of which 3 are adult; Don Diego, 4, of which only 1 is adult; Minca, 1. (See this Bulletin, XII, 1899, p. 208.)

Mr. Bangs gives *O. laticeps* (Lund) as occurring abundantly at 8000 feet in the Santa Marta Mountains. The three preceding species (*O. magdalenæ*, *O. villosus*, and *O. mollipilosus*) have been compared with authentic specimens of *O. laticeps* in the British Museum, and all prove to be decidedly different from *O. laticeps*. While closely related *inter se*, they are readily distinguishable by the characters already given.

26. **Oryzomys trichurus** Allen. — Five specimens, 3 adults and two young, from Bonda and immediate vicinity. (See this Bulletin, XII, 1899, p. 206.) The tail varies greatly in amount of hairiness, in two specimens the tail being scantily clothed, and in the third (the type) heavily clothed. Possibly more than one species is represented by these specimens.

27. **Oryzomys (Melanomys) columbianus** (Allen). — Seven specimens; 6 from Manzanares and 1 from Minca. (See this Bulletin, XII, 1899, p. 203.)

A reëxamination of these specimens shows that the original reference of this species to *Akodon* was erroneous. While *Akodont* in many features, it is better referred to *Oryzomys*, as a member of Thomas's subgenus *Melanomys*, proposed for *O. phæopus* and its near allies.

Mr. Bangs reports *Rhipidomys venezuelæ* Thomas from the Santa Marta Mountains, but there is no representative of this genus among the Muridæ of the Smith Collection. My *O. trichurus* is not a *Rhipidomys*, as suggested by Mr. Bangs (Proc. N. Engl. Zool. Club, I, 1900, p. 94).

28. **Sigmodon sanctæmartæ** Bangs. — Ninety specimens, skins and skulls, and 7 additional skeletons, of which about one half were collected at Minca, at altitudes varying from 100 to 2000 feet, and the rest at Bonda, Onaca, and neighboring localities at altitudes varying from 100 to 500 feet.

In coloration and general external appearance, *S. sanctæmartæ* greatly resembles *S. borucæ* from Costa Rica, and *S. bogotensis* from Bogota, Colombia; nor is there apparently

very much difference in size or proportions, as shown by the following measurements of 38 adults (the females all show marks of having suckled young) from the Santa Marta district.

		Total length.	Tail vert.	Hind foot.
Bonda and Onaca,	7 spec. ♂	280(254-302)	122 (113-130)	34 (30-38)
" " "	3 " ♀	283(264-298)	118 (111-127)	32.3(30-35)
Masinga Vieja,	7 " ♂	303(275-320)	127 (122-145)	35 (33-37)
" " "	4 " ♀	294(270-305)	127.5(123-130)	34.7(33-36)
Minca,	8 " ♂	276(260-303)	122 (113-132)	31 (29-35)
" " "	9 " ♀	265(254-291)	116 (103-120)	31.5(29-35)
<i>S. borucæ</i> ,	Type ♀	275	115	32
<i>S. bogotensis</i> , <sup>1</sup>	8 spec.	275	100	33

The pelage in *S. borucæ* is much softer and less hispid than in the Santa Marta form, and the general color is less ferruginous. These features are much more strongly evident in the young in first pelage than in the adults, the contrast in color between the young examples in the two series being very marked; the young of *S. borucæ* are rusty brown while the others are much darker, having only a slight fulvous wash in place of the strong rusty wash in *S. borucæ*. The ear is also very much larger in the Santa Marta form than in *S. borucæ*, and less heavily clothed.

[Since the manuscript of this paper was sent to the printer Mr. Outram Bangs, Curator of Mammals at the Museum of Comparative Zoölogy, Cambridge, Mass., has generously sent me, in response to my request for certain specimens, nearly all of the Santa Marta Muridæ (only the genera *Sigmodon* and *Mus* being omitted) collected by Mr. W. W. Brown for collation with the Muridæ of the Smith collection, with the request that I should describe any species that might prove new. It is needless to say that such courtesy is greatly appreciated; and the following is submitted as a supplement to the foregoing enumeration of the Muridæ of the Smith collection.

Of the 9 species of indigenous Muridæ recorded by Mr. Bangs as collected by Mr. Brown, 5 are represented in the Smith collection, the other 4 being apparently not found in the region explored by Mr. Smith's collectors. On the other hand the Smith collection contains 4 not obtained by Mr. Brown, making a total of 13 species of Muridæ thus far recognized from the Santa Marta region. The following is a collation of the two collections.

<sup>1</sup> Measurements approximate, from skins.

*Rhipidomys venezuelæ* Bangs (Proc. New Engl. Zool. Club, I, 1900, p. 92). — Not represented in the Smith collection. The 9 specimens sent for examination were taken in the Sierra Nevada at altitudes of 3000 to 8000 feet. On comparison of this series with eleven topotypes of true *R. venezuelæ* from the mountains of Merida (altitude about 4500 feet), the two series are distinguishable at a glance, the Sierra Nevada specimens being much redder than the Merida series, including the immature specimens as well as the adults. The general color above, instead of being dull grayish fulvous as in *R. venezuelæ*, is reddish brown, varying in different specimens from fulvous to rufous. Individual specimens from the two series can be very closely matched, but the two series when compared collectively are decidedly different. A comparison of the collectors' measurements shows very little difference in size, nor is there any appreciable difference in cranial characters.

*Oryzomys meridensis* Bangs (*l. c.*, p. 92). — This, as Mr. Bangs supposed, is my *O. maculiventer*, which, while a member of the *meridensis* group, proves to be satisfactorily distinct on comparison of topotypes of the two forms, as noted above.

*Oryzomys laticeps* Bangs (*l. c.*, p. 93). — Of the 13 specimens sent for examination 12 are from Pueblo Viejo (alt. 8000 ft.) and 1 from Palomino (alt. 5000 ft.). This is my *O. mollipilosus* from Valparaiso (alt. 4500 ft.) in the San Lorenzo Mountains. The younger specimens are practically indistinguishable from the original specimens (young adults) of *O. mollipilosus*, but the old specimens, with much worn teeth, are larger and paler with coarser pelage.

A careful study of Mr. Bangs's fine series leads me to question the distinctness of my *O. magdalenæ* from *O. mollipilosus*. My *O. villosus*, also from Valparaiso, is, however, very distinct from *O. mollipilosus*, being easily distinguishable by its large, naked ears, and strongly marked cranial characters.

*Oryzomys flavicans illectus* Bangs (*l. c.*, p. 94). — As noted above, this is quite different from true *O. flavicans* Thomas, from Merida, and should stand as *O. illectus* Bangs. The series of 8 specimens sent me by Mr. Bangs, nearly all from Pueblo Viejo (alt. 8000 ft.), is strikingly different from a series of 20 topotypes of true *O. flavicans*; no specimens in the two series can be found that approach each other very closely, especially in the color of the underparts. The coloration of *illectus* is very much deeper throughout, being very much more rufous above, and orange buff below instead of nearly clear white. It is also much larger. The differences in coloration are parallel to those between *Rhipidomys venezuelæ* of Merida and the Sierra Nevada, but very much greater. A comparison of the skulls of *O. flavicans* and *O. illectus* shows that the two forms are by no means closely related, *O. illectus*

having much shorter and smaller palatine foramina, larger bullæ, broader postpalatal fossa, etc., than *flavicans*.

As noted above, there is only a single specimen of this species in the Smith collection, taken at Don Diego in the San Lorenzo Mountains. My *O. trichurus*, from the coast at Bonda, which Mr. Bangs (*l.c.*, p. 94) considers to be probably a compound of *R. venezuelæ* and his *O. flavicans illectus*, is not only not a *Rhipidomys*, but has no close — only a congeneric — relationship to *O. illectus*.

*Oryzomys (Oligoryzomys) navus* Bangs (*l.c.*, p. 95). — Not represented in the Smith collection.

*Oryzomys (Oligoryzomys) dryas humilior* Bangs (*l.c.*, p. 95). — Not represented in the Smith collection.

*Oryzomys (Zygodontomys) phæopus obscurior* Bangs (*l.c.*, p. 95.) — This is my "*Akodon*" *columbianus* (see above, p. 437).

*Oryzomys (Erioryzomys) monochromos* Bangs (*l.c.*, p. 97). — Not represented in the Smith collection.]

29. **Heteromys jesupi** Allen. — Twenty-two specimens, from seven localities ranging in elevation from sea-level to about 2000 feet. (See this Bulletin, XII, 1899, p. 201.)

30. **Proechimys mincæ** (Allen). — One hundred and twenty-five specimens, skins and skulls, and 14 additional skeletons and several skulls, about two thirds of which were taken at Minca and the rest at or near Bonda. They include a large number of adults of both sexes and young of all stages of immaturity. There is, however, little to add to the account of the species already given. (See this Bulletin, XII, 1899, p. 198.)

31. **Proechimys canicollis** (Allen). — Ninety specimens, skins and skulls, and several additional skeletons and skulls, of which about one half are from Bonda and the rest from Santa Marta and nearby localities. (See this Bulletin, XII, 1899, p. 200.)

"*Proechimys mincæ* and *P. canicollis*. — The latter is the commonest rat below 1000 feet; the former takes its place in open lands, dry forests and thickets from about 1000 to about 2500 feet; but it does not extend far into the true mountain forest. Some *mincæ* are found nearly to sea-level, and *canicollis* occurs, rarely, to 2000 feet. Both live in holes in the ground, commonly in shady places and not far from streams. The proportion of tailless individuals is greater than Dr.



Allen has indicated, as we rejected a large proportion of them. I should say that one half of the adults taken had lost their tails, wholly or in part. In two or three cases we found the flesh and bones of the tail separated, so that it hung by the skin." — H. H. S.

32. *Isothrix rufodorsalis* Allen. — One specimen, adult male, Onaca. (See this Bulletin, XII, 1899, p. 197.)

33. *Coendou sanctæmartæ*, sp. nov.

Type, No. 15460, ♀ ad., Bonda, Santa Marta district, Colombia, April 28, 1899; coll. Herbert H. Smith.

Type: General color above dark brownish black, punctated with white. The quills for their basal fourth or third are white, then blackish or brownish black tipped with clear white, the length of the white tip varying according to the region of the body, averaging about 5 mm. over the greater part of the back and sides, but increasing in length on the top of the head, nape, shoulders, lower back, and basal half of the tail to about 10 mm., a few reaching 13 to 15 mm. Belly and limbs grayish brown, the pelage on these parts consisting of slender spines mixed with spiny hairs, the latter with fine hair-like tips. The pelage of the back consists almost wholly of spines, without any intermixture of hairs.

Two other specimens agree essentially with the type, except that in one the light tips of the spines of the anterior part of the back have the white replaced by pale chestnut; a fourth shows a similar variation in the color of the tips of the dorsal spines, and in addition has a slight intermixture of brownish woolly hairs among the spines over the posterior part of the back.

Represented by 5 specimens—four skins and skeletons and one additional skeleton—all taken in the immediate vicinity of Bonda, April 15 and 28, and June 10 and 14. Two are males and 3 are females, all adult. As shown by the following measurements, the males are considerably larger than the females.

*External Measurements.*

15459,	♂,	total length,	941;	tail,	433;	hind foot,	95.
23471,	♂,	"	"	941;	"	476;	" " —
15460, <sup>1</sup>	♀,	"	"	787;	"	433;	" " 89.
23472,	♀,	"	"	737;	"	344;	" " 89.
23473,	♀,	"	"	750;	"	—;	" " 83.

<sup>1</sup> Type.

*Cranial Measurements.*

	15459	2347 <sup>1</sup>	15460 <sup>1</sup>	23473	23472
	♂	♂	♀	♀	♀
Total length.....	89	85	82	79.5	84
Basilar length.....	78	74	70	65	67
Zygomatic breadth.....	49	50	50	46	—
Nasals, length.....	30	30	29.5	25.5	30
“ breadth anteriorly....	21	20	19	18.5	19
“ “ posteriorly....	23.5	21	21	21	19
Interorbital breadth.....	33	32	32	31.5	29
Depth of skull anteriorly....	40.5	37	37	35	36
“ “ occiput.....	22	23	23	21.5	22
Diastema.....	23	22	20	19	20
Length of palate.....	39	39	35	32.5	35
“ “ upper toothrow....	20	19.3	19	17.5	18

*Coendou sanctæmartæ* is a small form of the *C. prehensilis* ('*Synetheres*') group, but differs from *C. prehensilis*, *C. brandti*, and *C. centralis* in being about one third smaller than either of the three forms and very differently colored, the spines being much more narrowly tipped with white, the basal white portion narrower, and the dark portion much broader, so that the general coloration of the dorsal area is blackish punctated with white, instead of white varied with black, or black and white about equally mixed. The males are much larger than the females, but the largest male skulls are very much smaller than even the smallest skulls of the *C. prehensilis* group.

The series of 5 skulls of *C. sanctæmartæ* show great variation in the amount of inflation of the frontal region of the skull. In No. 15459 (♂) the front third of the nasals is nearly flat, but at the posterior border of the front third they rise abruptly to meet the greatly inflated frontals, this enormous inflation involving also the width of the posterior arm of the premaxillaries. In Nos. 23473 (♀), 23472 (♀), there is also considerable inflation of the frontal region, but in the other two skulls (including the type) there is very little, the nasals and frontals being nearly as flat as in the *Spiggurus* group. For this reason it seems impossible to differentiate satisfactorily forms in a group subject to such an extraordinary amount of individual variation in the form of the skull as is evident in the

<sup>1</sup> Type.

'*Syntheres*' group without having large series of specimens for examination.

"Tree-porcupines are found occasionally both in the dry forest and in the mountains, but I could learn little about their habits; they are certainly slow and clumsy animals, commonly seen only on the larger branches of high trees, seldom on the ground. At El Libano (5500 feet) one of these animals was shot, but the specimen was lost; it was, apparently, distinct from the kind collected near Bonda." — H. H. S.

34. *Dasyprocta colombiana* Bangs. — Thirty-five specimens, of which 23 are skins with skulls, 3 skins without skulls, 4 skulls without skins, and 5 skeletons. They include young of various ages, as well as adults. Less than one half were sexed by the collector, and only about one fourth have flesh measurements. All were taken at or in the immediate vicinity of Bonda.

Young, about one fourth grown, are darker and deeper colored throughout than the adults, and the long black hairs of the rump lack the whitish tips present in the adults.

As the species was described from immature specimens (*cf.* Bangs, Proc. Biol. Soc. Wash., XII, 1898, p. 163), the following measurements of adults will supplement the original description.

The flesh measurements of 8 adults are as follows:

15438, ♂,	total length,	521;	tail,	37;	hind foot,	127.
15436, ♂,	"	"	545;	" —;	" " 140.	
14871, ♂,	"	"	533;	" —;	" " —.	
23454, ♂,	"	"	545;	" —;	" " —.	
15437, ♀,	"	"	535;	" 37;	" " 140.	
15444, ♀,	"	"	610;	" 22;	" " 140.	
15445, ♀,	"	"	648;	" —;	" " 133.	
23455, ? ,	"	"	660;	" —;	" " 140.	

Four 'old adult' skulls measure as follows: Occipito-nasal length, 121.5 (120-124); basal length,<sup>1</sup> 97 (95-99); zygomatic breadth, 53 (51-55); mastoid breadth, 40.5 (40-41); interorbital breadth, 33.5 (32-34); breadth across postorbital processes, 43.7 (42-45); length of nasals, 48 (47-49).

<sup>1</sup> Mr. Bangs gives the basal length of "a ♀ young adult," as 169.4 — obviously a typographical error for 69.4.

This species greatly resembles *D. variegata* in coloration, but it is paler, very much larger, and differs markedly in cranial details.

"AGOUTI (called *iñeki*). — Common principally in the dry forest region, in woods or thickets; I do not think that it ranges far into the mountains. It makes deep burrows under roots and brush, and its habits and food are much like those of the paca." — H. H. S.

35. **Agouti paca** (*Linn.*). — Six specimens: 3 skins with skulls, and 3 additional skulls. Five are from Bonda, and the other from Baritaca.

"PACA (so called in Colombia). — Of all the South American rodents, this is the most esteemed for food; consequently it is much hunted and, being heavy and slow in its movements, is easily killed. It is also a favorite prey of the larger carnivora, and were it less prolific it would speedily become extinct. It is now rather rare near Santa Marta. Our specimens were shot in the dry-forest region, below 2000 feet, but it ranges into the mountain forest. Pacas make deep burrows, generally under roots of trees, and they eat herbage and various forest fruits." — H. H. S.

36. **Hydrochærus hydrochæris** (*Linn.*). — One specimen, immature, Mamatoca.

"CAPIVARA (called by that name, but it was derived from Brazil; *capim-vara*, shortened to *capi-vara*, means a dweller in the grass in the Tupi language). — This is now a rare animal in the immediate vicinity of Santa Marta, though common further east and along the Magdalena flood-plain; our specimens were shot near Mamatoca, on the Manzanares River. They are never found far from the water and prefer places where there is tall grass, partly submerged. The diet seems to consist mainly or entirely of grass or certain small fruit. They are stupid animals and quite harmless. I was once knocked over by one which ran against me in the high grass near an Amazonian lake.

"Capivaras are very prolific, and a female is commonly seen with several young, all of different sizes; probably this has given rise to the idea that conception takes place during

gestation. It appears that only one young is born at a time, and probably the period of gestation is short. The flesh is considered unfit for food, owing to its strong musky odor; but this may be avoided by skinning and cleaning the animal immediately after death. I knew a planter who often gave his guests capivara meat for dinner, and they all liked it. It is white, tender, and good." — H. H. S.

37. *Sylvilagus superciliaris* Allen. — Twenty-four specimens, including young of various ages as well as adults, all from Bonda. (See this Bulletin, XII, 1899, p. 196.)

"RABBIT (called *conejo*). — Common in the dry-forest region, frequenting thickets and old clearings where the bushes and grass give it cover. They are nocturnal, being seldom seen during the day unless driven from their retreats; they eat tender young leaves, buds, twigs, and roots, and perhaps small fruits. I have never seen any rabbit burrows, and the hunters aver that they do not make any, but bring forth their young in sheltered places among the grass and bushes. Generally two or three young are found together. As far as I know, rabbits do not range into the mountain forest."—H. H. S.

38. *Felis concolor* Linn. — Not represented by specimens. Mr. Brown obtained a specimen at Santa Marta and another at Dibulla (Bangs, Proc. N. Engl. Zool. Club, I, 1900, p. 99).

"PUMA (called *leon*). — Found occasionally below 3000 feet, principally in the dry forest; I never heard of it in the higher mountains, and it seems to be less common than the jaguar. We did not secure a single specimen of either; this was mainly ill-fortune, but it was partly due to the fact that no good dogs could be obtained, and it is almost useless to hunt large cats without them.

"South American hunters rather despise the puma; they consider it cowardly, and not to be compared with the jaguar for fierceness, agility, or strength; apparently it never attacks a full-grown man unless it has been brought to bay. Like the jaguar, it wanders at night and during the cool hours of the day, remaining quiet in the afternoon. It is said to make its den in rocky places, under a ledge; but I cannot attest this." — H. H. S.

39. *Felis onca* Linn. — Not represented in the collection. A specimen was obtained at Dibulla by Mr. Brown (Bangs, Proc. N. Engl. Zool. Club, I, 1900, p. 99).

"JAGUAR (called *tigre*). — This animal is quite common, ranging from sea-level to 6000 feet at least; but possibly those found in the mountains are another form. All over tropical America the hunters recognize two kinds of jaguars; their testimony is unanimous and I am inclined to think they are right. It is noteworthy that this distinction was recognized by the aborigines, at least those of the Tupi-Guarany stock, and they had two names, *jaguára* and *jaguára pacoua-sororoca*, the latter meaning 'jaguar of the wild plantain,' because it frequents places where the plant grows. The *jaguára* is almost exclusively a highland form; the other is more common along the rivers, especially on the great flood-plains like those of the Orinoco, Amazon, and Paraguay; this kind takes to the water readily and may often be seen swimming across broad rivers, as I have noted more than once. This, also, is the kind that is said to catch fruit-eating fish, attracting them by rapping the water to imitate falling fruit, and then knocking them out with its paw; once, when I was canoeing at night on one of the Amazonian channels, a sound as of dropping fruit was heard, and the Indian crew said it was a jaguar fishing; a gentleman who was with me said that he had heard the sound before, and had no doubt that the Indians were right. I mention this because the story has been published by various travellers, and has been regarded as a 'yarn.' In fact, there is nothing impossible about it; the pacu fish will come to such sounds and the ruse is used in catching them.

"According to the hunters, the two kinds of jaguar are of about the same size, but the highland form is rather more slender, with longer legs; they aver that it can be readily recognized by its cry. They say also that it is difficult or impossible to distinguish the skins of young animals, but that in the adults, the *pacoua-sororoca* has larger spots, distinctly arranged in 'roses'; in the *jaguára* the spots are smaller and more evenly distributed. The Santa Marta hunters speak of the two kinds, but have no distinctive names. The black

jaguar is not found at Santa Marta, and from all I have heard it seems to be almost confined to the great river plains. The hunters scout the idea that this is a variety of the jaguar; they say it is commonly larger and always fiercer, and that it has a peculiar cry; that black females always go with dark cubs and spotted ones with spotted cubs. I am more inclined to doubt this than the other report; the mere difference of appearance would lead the hunters to regard the black jaguar as distinct. Some skins which I have seen on the Paraguay were dark without being actually black, and they showed the spots plainly. If the black jaguar is a melanic variety it is of the *pacoua-sororoca*. I give these reports because they seem interesting, and hunters are generally good authorities on such questions. I may note in passing that the same men recognize only two kinds of coati (one kind in southern Brazil), though naturalists have described a great number; and they do not divide other variable species, such as the tamandua.

“Jaguars are much fiercer than pumas, and I know of several instances where they have attacked man unprovoked, even springing on him from behind, and in broad daylight. They are readily brought to bay by dogs, and fight them fiercely, often killing several before the hunters come up. The spear-hunters of the Paraguay, after bringing the jaguar to bay, provoke them to spring on the spear, which is held diagonally with the butt resting on the ground. Jaguars fight almost entirely with their paws, the claws sheathed, so that the weapon is, in effect, like a padded club. The force of their blows is very great. A large dog, belonging to one of my Brazilian hunters, was hurled twenty feet and was literally crushed against a tree trunk. I once found a deer which had just been killed by a jaguar and was still warm; it was only on close examination that I found a small scratch on the shoulder; not a bone was broken, and there was little suffusion of blood. The animal had been knocked dead with a paw like velvet.

“These animals are a great pest about cattle estates, killing calves or even old cows or bulls, and often pigs; they drag their

prey to the nearest forest to feast on it at their leisure. I never heard of them throwing a dead animal on their shoulders as tigers are said to do, and I fancy none of the cats could perform that feat. But the strength of the jaguar is sufficiently shown by its dragging large animals. In Brazil, my wife and I once followed a track on which a cow had been dragged; it was fully half a mile long, at first over open land and then in tangled forest. The carcass was found untouched, and our hunters subsequently shot the jaguar, which was hidden near by; it was not an unusually large one. . . .

"It is commonly said that jaguars will not attack a sleeping man, but will wait until he moves. A Brazilian engineer of my acquaintance, while waiting for a messenger, went to sleep in the forest; the messenger, on his return, found a jaguar 'smelling' of the sleeper, as he reported; the animal made off, but its tracks corroborated the story. I myself have found large jaguar tracks close to the hammock in which I had slept, a little away from the camp circle.

"Like most cats, they seem to fear a light at night, perhaps because they do not understand it. On one occasion while mothing in the mountain forest near Santa Marta, I carried a lantern about to examine my sugar baits; next morning we found jaguar tracks following mine for half a mile. At this place jaguars were frequently heard moving through the shrubbery, quite near our camp; and a month after we had left it, a visit to the place showed that a jaguar had occupied the improvised bed which my wife and I had slept in.

"This and other cats, as well as wild and tame dogs, are very fond of mangoes; and during the mango season they come around the settlements to eat the fruit. They often pass over several miles of country in their hunting excursions; in fact, it is doubtful if they have settled homes except during the breeding season. On one occasion our hunters tracked a jaguar for fully ten miles, on a high mountain.

"The male remains with the female while the cubs are young, and this, I believe, is the rule with all American cats; but he makes long hunting excursions while his mate remains near her cubs. Jaguars live principally on deer, pacas,



agoutis, and cattle or pigs when they can get them; more rarely they attack wild hogs or tapirs. It is certain that the *pacoua-sororoca* is an experienced fisherman, whether or not he catches fish as reported; it is also said to attack alligators and turtles, turning the turtle over and scooping it out of its shell; but I cannot attest this. Jaguars also eat several wild fruits, such as the 'hog-plum' (*Spondias*).

"The jaguar does not climb trees, at least habitually. It often 'sharpens its claws' on a tree trunk, as cats do on a chair leg; particular trees are used over and over again for this purpose." — H. H. S.

40. ***Felis sanctæmartæ*** Allen. — Two specimens, Bonda, as already recorded (this Bulletin, XX, 1904, p. 332, Oct. 8, 1904).

"OCELOT (called *tigrillo*). — Moderately common. It is found near the coast, but I do not know its mountain range, though specimens were shot at about 3500 feet; our hunters said they saw it in the Libano Mountain at nearly 6000 feet. Unlike the jaguar, it climbs trees readily, though seen quite as often on the ground. It commonly preys on large game birds as well as rabbits and other rodents, and it is a great poultry thief. Ocelots are not at all feared, and even small boys will attack them with stones. Like jaguars they are fond of mangoes and certain forest fruits. The den is said to be made in a hollow tree." — H. H. S. [Evidently Mr. Smith has not distinguished between the two — large and small — spotted cats found at Santa Marta.]

41. ***Felis* sp. incog.** — One specimen, adult male, and an additional skull, Bonda, March 30. This species appears to belong to the *Felis pardinoides* group, as recognized by Thomas (Ann. and Mag. Nat. Hist., (7) Aug., 1903, p. 236), but lack of material for comparison prevents a satisfactory determination. Collector's measurements: Total length, 927; tail vertebrae, 396. The skulls measure 95 x 63 and 94 x 63.

42. ***Felis yagouarondi*** Desmarest. — One specimen, adult (sex not determinable), near Bonda, March 1. The only flesh measurement available is, total length, 1018. The skull measures 109 x 66. I refer also to this species a kitten in [November, 1904.]

first pelage; it is nearly uniform black, with the tips of the hairs subapically ringed narrowly with gray.

43. *Felis eyra* *Desmarest*. — One specimen, adult female, Masinga, March 14. Collector's measurements, total length, 916; tail vertebræ, 432. Skull, 95 x 60.

"GATO PARDO. — This brown, slender cat is quite common near Bonda and along the coast, and ranges upward to at least 4000 feet. It seems to be mainly terrestrial. The only living one I have seen was standing on a rock, and it fled when my companion, a boy, threw a stone at it." — H. H. S.

#### 44. *Canis* (Thous) *aquilus* (Bangs).

*Urocyon aquilus* BANGS, Proc. Biol. Soc. Wash., XII, 93. April 30, 1898. Santa Marta Mountains, Columbia.

Fifteen specimens (skins and skulls) not sexed, but evidently representing adults of both sexes and young adults, and 6 additional skeletons, all taken in the vicinity of Bonda, in December, January, February, May, August, September, November, and March. Only a part have external measurements. The series varies little in respect to coloration. Measurements of 7 adults, taken by the collector before skinning, are as follows:<sup>1</sup>

14851, ♂, total length, 978; tail vertebræ, 286.	
14627, ♂?, " " 965; " " 263.	
14853, ♂, " " 959; " " 349.	
14623, ♀?, " " 927; " " 260.	
14626, ♀?, " " 914; " " 274.	
23503, ?, " " 927; " " 248; hind foot, 133.	
23504, ?, " " 940; " " 324; " " 146.	

Eight adult skulls measure as follows:<sup>1</sup>

14627, old ♂?, total length, 139; basal length, 131.5; zyg. breadth, 80.	
14853, ad. ♂, " " 137; " " 129; " " 73.5.	
14637, yg. ad. ♂?, " " 134; " " 128.5; " " 69.	
14625, old ♂?, " " 134; " " 127; " " 75.	
14635, ad. ♀?, " " 134; " " 126; " " 71.	
14623, ad. ♀?, " " 132; " " 126.5; " " 69.5.	
14626, ad. ♀?, " " 130; " " 124; " " 68.	
14624, old ♀, " " 128; " " 123; " " 73.	

<sup>1</sup> The question mark after the designation for sex in both the above tables indicates that the determination is presumptive; in the other cases the sex is positively determinable by the skins.

*Canis aquilus* is scarcely distinguishable externally from Venezuela specimens of *C. cancrivorus* (see *antea*, p. 343). The skull, however, is shorter and broader, with relatively heavier dentition; the facial portion of the skull is very much broader than in *C. cancrivorus*. In this species, as in other numbers of the American Canidæ, except *Urocyon*, the position of the temporal ridges varies with the age of the animal; in young adults they are slightly developed, and run about midway down the parietal convexity of the skull, as in other species of *Canis*; with increase of age they become stronger and move inward, in very old specimens uniting, as usual, at least posteriorly, to form a more or less distinct sagittal crest, — an entirely different position and mode of development from the supraorbital ridges in *Urocyon*.

Two specimens received recently from Merida, Venezuela, appear also to be distinctly referable to *C. aquilus*.

"WILD DOG (called *soro*, but this name is used for various other small carnivora, sometimes *soro perro*, dog-soro). — Moderately common below 3000 feet, and may range above that; but it seems to belong properly in the dry-forest region. It is exclusively terrestrial, at most walking on logs or rocks, like a dog; it preys on small rodents, lizards, etc., and perhaps crustacea, and eats many fruits. I could learn little of its habits, but apparently it makes its home in natural crevices of the rocks or in hollow trees. The animal has a strong and sickening odor, so that skinning it is a most unpleasant job. It is very uncleanly; the pelage is commonly so soiled and matted that it can only be cleaned with great difficulty. The wild dog is diurnal, but also wanders at night, at least when it is not very dark." — H. H. S.

45. **Conepatus mapurito** (*Gmelin*). — Two specimens, Bonda and Playa Brava, January and September.

"SKUNK. — Common in the dry forest, and found occasionally in the mountains to 4500 feet or higher. They live in natural crevices, stumps, etc., and appear to prey on small mammalia, birds and lizards; but the hunters avoid them and really know little about their habits." — H. H. S.

46. *Lutra colombiana*, sp. nov.

Type, No. 15479, ♀ ad., Bonda, Santa Marta district, Colombia, August 18, 1899; coll. Herbert H. Smith.

Color above pale reddish brown (between Prout's brown and hair brown of Ridgway); below pale grayish brown, the hairs and fur very pale brown basally, the hairs with long yellowish white or soiled white tips. Nose pad with the upper border double-concave, the lower border straight; transverse width, 15 mm., vertical width, 10.

Total length (type), 979; head and body, 547; tail vertebræ, 432; hind foot, 96. Two other adults are slightly smaller, the three specimens measuring: Total length, 966 (934-997); head and body, 555 (547-565); tail vertebræ, 411 (387-432). Skull (type), basal length, 101; zygomatic breadth, 67. (For detailed measurements see table below.)

Represented by 4 specimens: 1 skin and skull, 2 skins with skeletons, and 1 skeleton, all from Bonda, taken in February, August, and November. All are adult; two are sexed as females, while the sex of the others is not indicated. They differ little in color, but in the November specimen the pelage is longer, softer, and thicker than in the others.

## CRANIAL MEASUREMENTS OF OTTERS.

	<i>Lutra colombiana</i> . <sup>1</sup>				<i>L. insularis</i> . <sup>2</sup>	<i>L. annectens</i> . <sup>3</sup>
	15479 ♀	23507 ♀	23494 ♀	14633	4765	6678
Occipito-nasal length..	107	103	98	103.5	107	118
Basal length.....	101	98	94	92.6	104.5	112
Zygomatic breadth....	67	—	66	64	70.5	83
Interorbital breadth...	22	22.3	21.6	19	22	25.5
Postorbital breadth....	15	15	16.3	18.5	18.5	18
Mastoid breadth.....	64.6	64	61	—	67.5	76
Length of palatal floor.	43.5	43	41	42	45	48
Inner base of incisors to end of pterygoid proc	57	56	54.5	57	60.5	64
Postpalatal length.....	49	46	46	50	50	56.5
Upper premolar - molar series.....	30	28.5	29.5	30	30	31
Lower premolar-molar series.....	34	32	31.5	34	34	36
Pm <sup>4</sup> , length on outer border.....	12.3	12	11.3	12.4	12	12.3
Pm <sup>4</sup> , width at middle..	10	9.7	9	10	9.5	10.2
" oblique diameter <sup>4</sup>	13.5	13	13	14	13	13

<sup>1</sup> All from Bonda (Santa Marta), Colombia; coll. H. H. Smith.

<sup>2</sup> Princetown, Trinidad; coll. Frank M. Chapman.

<sup>3</sup> Laguna de Juanacatlan, Jalisco, Mexico; coll. Dr. A. C. Buller.

<sup>4</sup> Diagonally from the antero-internal point of lobe to postero-outer angle of tooth.

This species agrees with other South American otters in the general form of the braincase, which is low, flat, and much expanded, in comparison with the *Lutra canadensis* group of North America, in which the braincase is much narrower, deeper, and less expanded. The audital bullæ are very small and flat, the teeth large for the size of the skull and greatly crowded in the tooth line. It differs from *L. annectens* Forsyth-Major (from Jalisco, Mexico), which also belongs to the South American group, in its much smaller size and relatively much larger teeth, particularly  $pm^3$  and  $pm^4$ . A specimen of the latter from Laguna de Juanacatlan, Jalisco, Mexico (practically a topotype), has a basal length of 112, a zygomatic breadth of 83, and a mastoid breadth of 76, while the largest specimen of a series of four from Bonda has the corresponding measurements, respectively, 101, 67, and 64.6.

It is rather smaller even than *L. insularis* F. Cuvier, from Trinidad, which has the braincase higher and more convex, the audital bullæ about one fourth larger, and the dentition much weaker — nearly one third less massive — and the form of  $pm^4$  is strikingly different, the postero-internal basal portion in *insularis* being very narrow, instead of very broad as in *L. colombiana*. In short, *L. insularis* is a very strongly differentiated insular type, sharply set off from the other South American otters by strongly marked dental and cranial characters.

Unfortunately, no specimens of *L. enudris* (commonly emended to *enhydris*) F. Cuvier, described from Guiana, are available for examination. According to Forsyth-Major (Zool. Anz., XX, 1897, p. 141; Ann. and Mag. Nat. Hist. (6), XIX, 1897, p. 618), the audital bullæ are less flattened than in *L. canadensis*, but in *L. colombiana* they are very much more flattened than in *L. canadensis*, in this respect agreeing with *L. insularis*. In view of the several strongly marked local forms now so well known in the *L. canadensis* group, and the striking cranial differences that distinguish the Santa Marta animal from its nearest known geographical allies — the Mexican *L. annectens* on the one hand and the Trinidad *L. insularis* on the other, — and in view of the general fact

that all the well-known forms of Santa Marta mammals, and especially the Carnivora, differ markedly from their allies from Venezuela, Guiana, and Brazil, it seems pretty evident that the Santa Marta otter forms no exception to the rule. Furthermore, the advance of our knowledge of otters in general during the last fifteen years, and particularly those of North America, renders it even more probable now than in 1889, when Mr. Oldfield Thomas wrote an excellent paper on otters in general (Proc. Zoöl. Soc. London, 1889, pp. 190-200), that his suggestion (*l. c.*, p. 199) that there may be "one, two, three, or four Neotropical species in addition to those already mentioned [*Lutra brasiliensis* and *L. felina*]," is a foresight that will be verified by the recognition of not less than four additional species or subspecies as soon as the material for their satisfactory investigation becomes available; for all of which there are probably available names, heretofore generally treated as synonyms of a supposed single wide-ranging species.

"OTTER (called *Lutra*). — Found occasionally along the larger streams, living generally in pairs or families, in holes or burrows along the forest-lined banks. It never goes far from the water, and lives on fish. Otters are easily tamed and make most amusing and affectionate pets; they become attached to particular persons, following them about like dogs and often uttering their peculiar plaintive cry. I have seen a tame otter swimming with the village boys and evidently enjoying the sport. I am told that they can be taught to fish for their masters, but have never seen this." — H. H. S.

47. **Tayra barbara irara** *Allen*. — Fourteen specimens, skins and skulls, and several additional skeletons, all collected at or near Bonda. (See this Bulletin, XX, 1904, p. 36.)

Since my former note on this species several additional specimens have been found in a lot of duplicates not at that time examined. In two the white spot on the withers is present and in two it is lacking. I notice also that Mr. Bangs (Proc. New Engl. Zoöl. Club, I, p. 100) has reported the white shoulder spot present in three out of his five specimens. It is thus present in 16 out of 20 known specimens.

"*GALICTIS* (called *soro-huache*). — Moderately common below 3000 feet. It is arboreal, but frequently seen on the ground; its habits seem to be much like those of the kinkajou. The hunters distinguish two kinds, differing especially in the length of the tail; whether the difference is due to age or is varietal or specific I cannot venture to decide. Both forms vary greatly in color and markings." — H. H. S.

48. *Potos flavus megalotus* (*Martin*). — Eleven specimens (5 males and 6 females, all adult), collected near Bonda, March 24–June 17, and one in July and one in August. (On the name *megalotus* see this Bulletin, XX, 1904, pp. 72–74.)

These specimens have the dorsal surface bright rusty yellow, the extreme tips of the hairs reddish brown, not black or blackish as in the allied forms; the dark dorsal streak, which is dark reddish brown, is well defined in three of the specimens, irregular and imperfect in two, and quite obsolete in the remaining two; in several of the brighter specimens the general color above is bright reddish fulvous or 'foxy red,' in others much paler; ventral surface clear pale yellow, varying to golden, especially along the middle of the abdomen; top of the head darker than the back; back of the ears not darker than adjoining pelage; a more or less dusky eyering; upper surface of tail like the back, darkening somewhat towards the tip, the lower surface dull pale yellow.

One specimen (No. 14855, ♂ ad.) is strikingly different from the rest, the general coloration, especially of the upper parts, being much paler as regards the fulvous tints, with the hairs tipped with brownish black or dusky, and so extensively as to give a blackish cast to the central part of the dorsal area, from the head to the end of the tail, the well-defined dorsal stripe being continued to the end of the tail. In general effect it is widely different from any other specimen of the series, much more resembling *Potos flavus caucensis* from the upper Cauca Valley in southwestern Colombia.

The collector's measurements are as follows:

♂, total length,	1029;	tail vertebræ,	521;	hind foot,	114.
♂, " " "	1026;	" " "	508;	" " "	—
♂, " " "	1003;	" " "	489;	" " "	—
♂, " " "	978;	" " "	457;	" " "	108.
♀, " " "	953;	" " "	495;	" " "	108.
♀, " " "	965;	" " "	470;	" " "	114.
♀, " " "	915;	" " "	493;	" " "	102.
♀, " " "	914;	" " "	464;	" " "	93.
♀, " " "	914;	" " "	470;	" " "	102.
♀, " " "	895;	" " "	502;	" " "	102.

In these specimens the posterior fourth of the palatal floor is abruptly and deeply depressed (from  $m^2$  posteriorly); the teeth are of medium size, and the audital bullæ are well developed and considerably inflated. Two average middle-aged skulls, male and female, measure as follows: Total length, ♂ 89, ♀ 87; basal length (inner base of incisors to posterior border of condyles), ♂ 82, ♀ 79; zygomatic breadth, ♂ 57.3, ♀ 56.5; interorbital breadth, ♂ 19, ♀ 19; width of braincase, ♂ 36.5, ♀ 35; length of palate, ♂ 39, ♀ 36; upper premolar-molar series, ♂ 21, ♀ 19; lower premolar-molar series, ♂ 22, ♀ 20.6; length of lower jaw, ♂ 61, ♀ 59; height at condyle, ♂ 28, ♀ 29; height at coronoid, ♂ 40, ♀ 40.6.

"KINKAJOU (called *martico*). — Moderately common in forest below 3000 feet, and perhaps above that altitude; but most of our specimens were shot in the dry forest not far from sea-level. It goes singly or in pairs, is arboreal, seldom seen on the ground, and seems to be diurnal rather than nocturnal. It moves among the trees cautiously, choosing the larger branches, and does not make long leaps. It is said to live in hollows in the upper part of tree trunks; beyond that I learned nothing of its habits." — H. H. S.

49. **Procyon proteus** *Allen*. — Six specimens (2 males and 4 females, all adult), skins and skulls, Bonda. (See this Bulletin, XX, 1904, p. 333.)

"RACCOON. — Common in dry forest near the coast, and along the larger streams for a few miles inland; I do not think that it is found among the mountains [taken at 8000 feet by Mr. Brown]. It is mainly nocturnal in its habits, and is frequently hunted (for its skin) on the sand beaches during moon-lit nights. Its food consists largely of marine and fresh-water animals, fish, mollusca, and crustacea, and it also eats certain fruits.

"The *Coati* is not found near Santa Marta." — H. H. S.

50. **Myotis nigricans** (*Wied*). — Thirty specimens, Bonda (*l. c.*, p. 94<sup>1</sup>).

51. **Lasiurus pallescens** (*Peters*). — One specimen, Bonda (*l. c.*, p. 94).

<sup>1</sup> A list of the Bats in the present collection was published in this Bulletin, Vol. XII, 1900, pp. 87-94. A few species received later are here included. The reference, "*l. c.*" refers to that paper.



52. **Saccopteryx leptura** (Schreber). — Seven specimens, Bonda (*l. c.*, p. 94).

53. **Saccopteryx bilineata** (Temm.). — Thirty-six specimens, Bonda and Minca (*l. c.*, p. 93).

54. **Peropteryx canina** (Wied). — Eight specimens, Bonda (*l. c.*, p. 94).

55. **Molossus bondæ** Allen. — One specimen, Bonda (*antea*, p. 228).

56. **Promops affinis** Allen. — Six specimens, vicinity of Bonda (*l. c.*, p. 91).

57. **Promops glaucinus** (Wagner). — Four specimens, Santa Marta, collected and presented by Mr. Francis C. Nicholas. (Not represented in the Smith collection.)

58. **Thyroptera tricolor** Spix. — One specimen, Cacagualito (*l. c.*, p. 94).

59. **Chilonycteris rubiginosa** Wagner. — One specimen, Cacagualito.

60. **Dolichophyllum macrophyllum** (Wied). — One specimen, Bonda (*l. c.*, p. 91).

61. **Chrotopterus auritus** Peters. — One specimen, Bonda (*l. c.*, p. 91).

62. **Micronycteris hypoleuca** Allen. — One specimen, Bonda (*l. c.*, p. 90).

63. **Micronycteris megalotis** (Gray). — Nineteen specimens (*l. c.*, p. 90).

64. **Trachops cirrhosus** (Spix). — One specimen (*l. c.*, p. 90).

65. **Phyllostomus hastatus** (Pallas). — One specimen, Bonda (*l. c.*, p. 90).

66. **Hemiderma perspicillata** (Linn.). — Twenty-three specimens, Bonda (*Hemiderma brevicauda*, *l. c.*, p. 90) and Cacagualito.

67. **Glossophaga longirostris** Miller. — Thirty-four specimens, Bonda and vicinity (*l. c.*, p. 89).

68. **Glossophaga soricina** (Pallas). — Six specimens, Bonda.

69. **Artibeus palmarum** Allen and Chapman. — Four specimens, Bonda (*l. c.*, p. 89).

70. *Artibeus planirostris* (Spix). — One specimen, Mamatoca.

71. *Uroderma bilobatum* Peters. — Twenty specimens, Bonda, Cacagualito, and Minca (*l. c.*, p. 89).

72. *Vampyrops vittatus* (Peters). — Two specimens (*l. c.*, p. 88).

73. *Chiroderma jesupi* Allen. — One specimen, Cacagualito (*l. c.*, p. 88).

74. *Desmodus rufus* Wied. — Sixteen specimens, Bonda (*l. c.*, p. 87).

75. *Diphylla ecaudata* Spix. — One specimen, Cacagualito (*l. c.*, p. 87).

"BATS. — In general I can give no information beyond what appears on the labels. Blood-sucking bats of at least one species [two, *Desmodus rufus* and *Diphylla ecaudata*] are common along the coast, especially near the rivers Buritaca and Don Diego; they have literally depopulated several cattle estates, and many horses, mules, and even pigs are killed by their continued work. The planters say that these bats come down from the mountains, are numerous for a few months or a year or two, and then disappear. It is certain that they appear and disappear as stated, but it is more likely that they migrate along the coast. At Don Diego we were told that these bats slept during the day about the bases of the leaf-stalks of cocoa-nut palms. We saw bats of some kind there; but before any were captured our whole party was incapacitated by fevers, and we were obliged to leave." — H. H. S.

In addition to the 26 species of bats enumerated above, two others have been recorded by Mr. Bangs, namely *Vampyrops lineatus* (E. Geoffroy) and *Dermanura quadrivittata* (Wagner), both from the Sierra Nevada de Santa Marta at from 5000 to 8000 feet altitude.

76. *Alouatta seniculus rubicunda*, subsp. nov.

Type, No. 14655, ♂ ad., Bonda, Santa Marta district, Colombia, Dec. 22, 1898; coll. H. H. Smith.

Head, neck, limbs, tail, and ventral surface dark reddish chestnut (in fresh pelage often with a blackish tone); dorsal region dark

reddish orange (in fresh pelage often deep, dark red, fading into orange in worn pelage). Facial naked parts brownish black; "scrotum snow-white, a singular and striking sexual mark" (H. H. Smith).

Total length, 1346; head and body, 597; tail vertebrae, 749. Seven adult males average, total length, 1290; tail vertebrae, 703. Skull (type), total length, 118; zygomatic breadth,—(skull broken). Nine old male skulls average, total length, 121; zygomatic breadth, 104. (For further measurements see tables below.)

Represented by 84 specimens, of which 50 are skins with skulls or skeletons, 12 are skulls without skins, and 22 are skeletons without skins. All were taken at or near Bonda, and each month of the year is represented, though very few were taken in November and June, while February, March, May, July, and August are each represented by 10 or more specimens. Both sexes and young of various ages are included. Unfortunately only a few of the specimens were sexed and measured by the collector.

This large series shows a wide range of variation in color, which proves to be entirely independent of sex or age, and largely independent of season. The head, shoulders, flanks, limbs, and tail vary from light reddish chestnut to dusky purplish chestnut, and the dorsal area from golden yellow to brilliant reddish or even clear dark red. In several of the specimens the beard and front of the head are blackish. The apical third or more of the tail is often lighter than the limbs or basal portion, the terminal third not infrequently fading out to the color of the back, this condition agreeing with the *Myctes chrysurus* of I. Geoffroy.

The hairs individually are also variable in texture and color, the pelage being long, soft, silky and shining in the new, freshly acquired coat, and shorter, harsher, less shining and paler-colored in the worn coat. The darkest and richest-colored specimens are in fresh pelage, which, as shown by the dates of collecting, is acquired at different seasons by different individuals. In the paler, worn specimens the individual hairs are sometimes nearly concolor from tip to base; in the fresh, unworn pelage they are generally tricolor, the basal and apical thirds being much darker than the middle portion. The hairs of the dorsal region, in fresh pelage, are dusky at base, then orange, with long, dark, bright reddish tips, which later disappear to a greater or less extent by fading and wear, the basal third or fourth still retaining for a time its dark brown tint, this feature, however, varying greatly in different individuals. In fresh coat the head, neck, limbs, and tail are very dark reddish chestnut, with a decided tinge of blackish; on the head, neck, and shoulders the hairs individually have the basal third or fourth blackish brown, the middle third dark red, and the subapical fourth nearly black, and the extreme tips dark red, giving a dusky effect to the general coloration of these parts.

*A. seniculus rubiginosa* differs from true *A. seniculus* of Guiana in its much darker, richer coloration, and larger size. In the absence of skulls of true *seniculus* it is impossible to say whether or not they are also distinguished by cranial characters, which seems probable in view of the sharp differentiation in this respect of the red howler of the Cauca Valley from that of the Santa Marta district. That the group is sub-



Fig. 1. *Alouatta seniculus rubiginosa*. Type.  $\frac{2}{3}$  nat. size.



Fig. 2. *Alouatta seniculus caucensis*. Type.  $\frac{2}{3}$  nat. size.

ject to great local variation is abundantly shown by a fine series of 9 specimens from the upper Cauca Valley, collected at altitudes of from 3000 to 6000 feet in May and June, 1898, by Mr. J. H. Batty. These agree in pattern of coloration with the Santa Marta series, but differ widely in color, being many shades paler throughout, including the head, neck, flanks, limbs, and tail, as well as the dorsal area, which latter is deep straw yellow instead of reddish orange, while the

darker parts are proportionately lighter than in the Santa Marta series.

In the absence of extensive series from numerous localities, it would be presumptive to attempt to allocate the many names that have been bestowed by different authors upon the *seniculus* group of howlers. It is evident, however, that some of them have been based wholly on features subject to



Fig. 3. *Alouatta seniculus rubiginosa*. Type.  $\frac{2}{3}$  nat. size.



Fig. 4. *Alouatta seniculus caucensis*. Type.  $\frac{3}{4}$  nat. size.

a wide range of individual or seasonal variation. As shown by the present large Santa Marta series, there is little if any sexual variation in color contrary to the belief of many of the early writers.

The Cauca series is strikingly different from the Santa Marta series, not only in color and size, but in cranial characters, as shown below. As none of the names given to this group of howlers apply well to either the Cauca or the Santa

Marta forms, either geographically or otherwise, the Cauca subspecies may be provisionally distinguished as follows:

***Alouatta seniculus caucensis*, subsp. nov.**

Type, No. 14162, ♂ ad., Charingo (alt. 3000 ft.), upper Cauca Valley, Colombia, May 5, 1898; coll. J. H. Batty.

Head, neck, limbs and tail dark reddish chestnut, the latter much paler apically than at the base; back and sides golden yellow, deepening to orange yellow on flanks; pectoral region naked, ventral surface thinly clothed with reddish hairs. Total length, 1234; head and body, 603; tail vertebræ, 640; hind foot, 135; ear, 35. Skull, total length, 116; zygomatic breadth, 80. (For further measurements see table below.) The type has the largest external measurements of the series, but not the largest cranial measurements. Three adult males average, total length, 1155; tail vertebræ, 600; skulls of the same, total length, 119; zygomatic breadth, 77.5.

There is considerable variation in color, the brightest specimens closely approaching the faded specimens of the Santa Marta series. The two series, as a whole, however, differ strikingly in coloration, as indicated above.

*Alouatta seniculus caucensis* averages much less in external measurements than *A. s. rubiginosa*, and it has also a considerably smaller skull, but the most marked differences are in the cranial details. In *caucensis* the skull is narrower and flatter, the zygomata are much less expanded, the palatal region much narrower, and the rostral portion of the skull is much compressed, with correspondingly narrower nasals. Thus the nasals in *caucensis* have an average breadth at the front border of 10 mm. against 14 in *rubiginosa*, with the necessarily correlated difference in contour of the nasal region this implies, the least interorbital breadth being 2.5 mm. less in *caucensis*. In *rubiginosa* the upper toothrows in old males are often curved slightly outward and the palatal area is very broad; in *caucensis* the upper toothrows are straight and parallel, and the palatal area is much narrower, the distance between  $m^1$  in the two forms being, respectively, 24.6 (10 males) and 21.8 (5 males). (See figs. 3 and 4.)

The following tables of measurements show the difference in size in the two forms and in cranial proportions. (The

letters y., m., and o. indicate, respectively, young-adult, middle-aged, and old.) The females average smaller than the males, but some of the old males in the Santa Marta series are smaller than some of the females. That this exceptional condition is real and not due to mistakes on the part of the collector in sexing is shown by the skins, in which the sex is unmistakably evident.

## EXTERNAL MEASUREMENTS.

*A. Alouatta seniculus rubicunda.*

23373 ♂	Total length,	1308;	head and body,	622;	tail vertebræ,	686.
23371 ♂	"	"	1308;	"	"	—.
23374 ♂	"	"	1219;	"	"	648.
23376 ♂	"	"	1308;	"	"	718.
23385 ♂	"	"	1133;	"	"	718.
25754 ♂	"	"	1410;	"	"	—.
14655 ♂	"	"	1346;	"	"	749.
14653 ♀	"	"	1270;	"	"	711.
14654 ♀	"	"	1245;	"	"	711.
14656 ♀	"	"	1219;	"	"	660.
23377 ♀	"	"	1320;	"	"	749.
23757 ♀	"	"	1270;	"	"	730.
23360 ♀	"	"	1270;	"	"	—.
23361 ♀	"	"	1295;	"	"	—.

*B. Alouatta seniculus caucensis.*

14162 ♂	Total length,	1243;	h. and b.	603;	t. vert.	640;	h. foot,	135;	ear,	35.
14163 ♂	"	"	1185;	"	"	574;	"	611;	"	33.
14168 ♂	"	"	1045;	"	"	495;	"	550;	"	32.
14170 ♀	"	"	1014;	"	"	483;	"	531;	"	30.
14167 ♀	"	"	1050;	"	"	494;	"	556;	"	32.

# CRANIAL MEASUREMENTS.

## *Alouatta seniculus rubiginosa*.

	14655 ♂ o.	14651 ♂ o.	14647 ♂ m.	23380 ♂ o.	23364 ♂ o.	23370 ♂ o.	23354 ♀ o.	23369 ♂ o.	23379 ♂ o.	23372 ♀ o.	23355 ♀ o.	23358 ♀ o.	23338 ♀ o.	14649 ♀ o.	14654 ♀ o.	14660 ♀ o.	14653 ♀ o.	Average. 8 males 8 females.
Total length.....	118	117	122	122	118	117	116	125	127	121	111	99.5	105	103	116.5	114	107	121
Basal length (Hensel).....	104	98	106	106	101	97	98	111.5	113	103	93	84	85	86	87	93	85	104
Zygomatic breadth.....	—	70	82	82	78	70	70	84.5	84	79	72	69	72	70	—	79	68.5	80.3
Postorbital breadth.....	46.5	46.5	45	45	38	39	41.5	38	42	40	44.5	44	46	37	44	45	46	42.5
Interorbital breadth.....	15.5	14	15	15	12	15	15	10	17.5	17	15	14	14	14.5	13	13	14	14.8
Orbital breadth.....	74	66	67	69	66	69	69	74	74	74	64	62	62	60	60	65	60	70
Mastoid breadth.....	58.5	59.5	61	61	58	59	62	61	63	56	55	52.5	51	53	58	57.5	56	60
Palatal breadth at m.....	27	24	23	24	24	22	23	26	26	25	21	21	21	21	22	23	21	24.6
Palatal length.....	32	30.5	33.5	33.5	33	28	33	35	34.5	34	27	26	25.5	25	27.5	20	26	32
Rostral length.....	46.5	40	43	45.5	42	43	42	49	46	45	39	36	37	34	38.5	30.5	38	44.3
Postpalatal length.....	59	57	58.5	61.5	60	54	56.5	64	63	57	54	40	48	52	46.5	54	46.5	59.6
Front width of nasals.....	14	13	14	—	13	13.5	18	16	18	—	—	11	13	11.5	12	11	12	14.5
Upper prem-molar series..	36.5	34.5	38	36.5	36	35	37	36.5	35.3	35	32.5	34	33	32	32	35	37	36
Lower prem-molar series..	40	39	43.5	39.5	39	37.5	40	41	40	39	37	37	35	30	38	40	40	40
Length of lower jaw.....	101	99	98	100	96	95	92	100	104	100	88	81	83	81	84	90	82	100
Height of lower jaw.....	72	69	72	70	71	69	70	77	74	76	60	58.5	61	60	57	64	57	71.8

## *Alouatta seniculus caucensis*.

	14162 ♂ o.	14165 ♂ m.	14163 ♂ o.	14164 ♂ o.	14166 ♂ y.	14168 ♂ m.	14167 ♀ o.	14170 ♀ m.	Average. 6 males. 2 females.
Total length.....	116.5	117.5	123.5	—	119	106	100	97	116.5
Basal length (Hensel).....	97	96	104	103	86	85	81	—	95.1
Zygomatic breadth.....	80	77	82	81.5	70	67.5	69	64	76.3
Postorbital breadth.....	41	41	44	38	46	42	40.5	45	42
Interorbital breadth.....	13	11	15	14	11	12.5	13	10	12.7
Orbital breadth.....	67	64.5	69	68.5	64	59	58.5	54	65.3
Mastoid breadth.....	58	56	59	57	54	51	53	51.3	55.8
Palatal breadth at m.....	22	22	22	23	22.2	20	20.3	20	21.5
Rostral breadth.....	30	28.5	34	31	28.5	25	26	21	29.5
Postpalatal length.....	41	42	41	44.5	36	36	35	32	40
Palatal length.....	56	55	55.5	58	50	47	47	—	53.5
Upper width of nasals.....	9.5	9	10	11	9.3	8	8	8	9.4
Upper premolar-molar series..	36	36	36	36.5	35	35	33	31	35.7
Lower premolar-molar series..	41.5	41	42	41.5	41	38	36.5	34	40.8
Length of lower jaw.....	94	94	101	99	84	80	80	71	92
Height at condyles.....	68	63	81	70	60	55	54	50	66



"HOWLING MONKEY.—This is found both in the dry forest and mountain forest, ranging, apparently, to about 4500 feet; but it is more common near the coast. Howlers go in bands, commonly of five or six, led by an old male; they travel among the higher branches, rarely approaching the ground, and the males keep up a continuous rumbling cry, which may be heard sometimes at a distance of a mile or more. This sound is often heard at night, and it is evident that the animals travel then, though perhaps not when it is very dark.

"Of all American monkeys the howlers are the most intractable in captivity; we have tried to tame young ones, but they always showed resentment and fear, refused their food, and soon died. A *Cebus* or spider monkey, with the same treatment, becomes tame in a few days.

"The Santa Marta male howlers have the scrotum snow-white, a singular and striking sexual mark. I do not remember to have observed this in any of the Brazilian howlers, but I may have forgotten it. In other respects this species looks much like the red howler of the Amazon." — H. H. S.

77. **Aotoes lemurinus** (*Is. Geoffroy*).—Two specimens, Bonda, Nov. 18, and Valparaiso, June 29. The former, No. 14567, has been mounted, so that the skull is not available for examination; the latter, No. 15483, a young female, is much grayer and less rufous.

That the Santa Marta specimens are not *Aotoes felinus* (Spix) is evident from the color of the throat and fore neck, which is gray, in abrupt contrast with the rest of the ventral surface, instead of orange, uniform with the ventral surface, as in *A. felinus*.

The type locality of *Is. Geoffroy's Nyctipithecus lemurinus* was Santa Fé de Bogota, Colombia, and the species is represented in the Museum collection by a mounted topotype, in excellent preservation, purchased many years since from the Verreaux Brothers of Paris. Geoffroy described the species (*Arch. du Mus.*, IV, 1844, p. 24, pl. ii), "d'après les peaux et les crânes de plusieurs individus des deux sexes et de différents âges, que le Museum d'histoire naturelle avait reçus de Santa Fé de Bogota." He noted considerable variability in

color in this series, which he considered due to individual variation, as it was evidently not sexual.

The Museum Collection contains 7 specimens from the upper Cauca Valley (alt. 6000 feet), Colombia, collected by Mr. J. H. Batty, which I also refer to *A. lemurinus*. They include adults and young adults of both sexes, but unfortunately only four of the skins are accompanied by skulls. This series is exceedingly variable in details of coloration, varying individually in the amount of rufous and black, as described by Geoffroy. Yet it is impossible not to believe that they all represent a single variable species. They show essentially a close agreement with the topotype of *A. lemurinus* in size, proportions, and in the prevailing features of coloration. No. 14567, from Bonda, can be closely matched by several specimens in the Cauca series, and is also not appreciably different from the Bogota specimen. The other (No. 15483, from Valparaiso) is paler and grayer, with the ventral surface much paler and with much less rufous suffusion pervading the general pelage. The Valparaiso specimen is much more different from the Bonda specimen than the latter is from several of the Cauca specimens, but there is one Cauca specimen which closely resembles it. With larger series from each of these three localities it might be possible to distinguish a small amount of local differentiation in color or other features, but the material at present available for examination does not warrant such procedure.

According to Mr Brown's flesh measurements of two specimens taken by him at Santa Marta, near Bonda (Bangs, Proc. New Engl. Zoöl. Club, I, p. 102), the length of the tail vertebræ is considerably greater than half the total length; in the Smith specimens and in the Batty specimens these two measurements are equal. It is probable, however, that the method of measuring was not the same in all three cases. Spix says, "*cauda corpore multo longiore*," while his measurements are: "*trunci 1' 1½"*, *caudæ, 1' 2"*" which makes a difference of only half an inch between the two measurements. Adding the head — "*capitis 2½"*" — makes the head and body longer than the tail! In other words, the commonly

assumed difference in the relative length of the tail in the two species — *A. felina* and *A. lemurina* — is erroneous.

"NOCTURNAL MONKEY. — I know nothing of these monkeys except that they are occasionally found in the dry forest, near sea-level, sleeping in hollow trees during the day; generally two or three are found together. The few specimens brought in were very fat, even the skin being so oily that it was preserved with difficulty, and we lost several. The species may be more common than it appears; it is seldom observed owing to its habits." — H. H. S.

78. *Cebus capucinus* (Linn.). — Thirty-two specimens, of which 27 were taken at or near Bonda, 4 at Minca, and 1 at Cagualito. They include many adults of both sexes, as well as immature specimens of various ages. Nearly every month is represented, but they were taken mainly in March and April (5), October and November (6), and July and August (6). Even the adults are exceedingly variable in coloration, and thus conform to what other authors have written of this feature of the species.

Absence of material from Guiana, the type locality, or from any other localities, renders a comparative study of this fine series impossible.

The following external measurements are from the collector's labels, except that the head-and-body length is obtained from subtracting the tail length from the total length. As so often happens in mammals, and especially in those with long tails, the tail in the female is relatively longer than in the male.

#### EXTERNAL MEASUREMENT.

14620	♂	Total length,	959;	head and body,	495;	tail vertebræ,	464.
14849	♂	"	965;	"	508;	"	457.
15481	♂	"	965;	"	533;	"	432.
23392	♂	"	1003;	"	508;	"	495.
23394	♂	"	976;	"	472;	"	457.
23395	♀	"	889;	"	383;	"	504.
23396	♀	"	895;	"	400;	"	495.
23753	♀	"	914;	"	519;	"	495.
23751	♀	"	838;	"	393;	"	445.
14616	♀	"	876;	"	419;	"	457.
14617	♀ juy.	"	832;	"	444;	"	388.
14621	♀	"	876;	"	441;	"	435.

The largest male skulls have a total length of 96 to 100 mm., and a zygomatic breadth of 66 to 73; the largest female skulls, 88 to 95 by 58 to 61.

"BROWN MONKEY (called *Mico*). — The range is almost exactly the same as that of the howler, but the species is rather more common; it is often seen in pairs or bands of three or four. Micos are more active than howlers, taking long leaps from tree to tree; in so doing the tail is used precisely like a fifth hand, clasping the nearest branch when they alight. I have never seen these monkeys swing by their tails, though they sometimes swing by the posterior hands, using the tail as a fulcrum. But, as a rule, monkeys in the forest swing very little; they walk easily on the upper side of a branch, leaping to the nearest branch of the adjoining tree on the line of travel, or sometimes crossing by a vine-stem. They always follow a leader, presumably an old male, and they move after him in single file. Micos are very curious; if a man is passing beneath they stop to look at him, peering down through the foliage. Young ones are easily tamed, but in captivity they are mischievous and often fractious; generally they become attached to particular persons. Tame ones which we have kept slept all night, and I do not think this species travels after sunset. Micos are esteemed as food by the natives." — H. H. S.

Article XXXVI. — NOTICE OF A NEW GENUS AND SPECIES OF LOWER CARBONIFEROUS BRYOZOAN.

By R. P. WHITFIELD.

PLATE XI, FIGS. 2 AND 3.

Among the many forms of Bryozoans which characterize the Lower Carboniferous rocks of our Western States, none presents a more peculiar style of growth than that described below. In its general appearance in isolated fragments, the network portion resembles a *Polypora*, but when attached to the axis it is seen to be quite a different object. It is then paddle-shaped with a strong calcified axis on one edge of the spreading net-like expansion, the lower portion of which has been thickened to form the axis, obliterating the rays and cells so as to leave only a longitudinally striate solid stipe resembling a strong, coarse *Stictopora*. The description below and the figure given of the type specimen will serve to illustrate fully the form.

**Dictyoretmon,<sup>1</sup> gen. nov.**

Zoarium consisting of a broad triangular frond, rising from a root-like base, spreading out on one side of a solid, flattened axis in a net-like fenestelloid body, composed of radiating ribs with connecting bars as in *Fenestella*. Rays pore-bearing in two or more lines. The connecting transverse bars also pore-bearing as in *Polypora*.

**Dictyoretmon burlingtonense, sp. nov.**

Frond-paddle-shaped. Axis thin, flattened, consisting of a portion of the net-like frond excessively calcified and thickened so as to obliterate the pores, but leaving the surface grooved. In this condition the axis alone resembles a large coarse stipe of *Stictopora* curved to one side. The specimen, as seen on the rock, has a length of 13½ cm., with a width at the widest part of the frond of about 4½ cm. Rays arranged in longitudinal, slightly diverging lines fourteen to sixteen in the space of 1 cm. Connecting dissepiments six to eight in 1 cm. Fenestrules oval. Pores large and open, four or five to a fenestrule, in two or three rows with four to six on each connecting dissepiment.

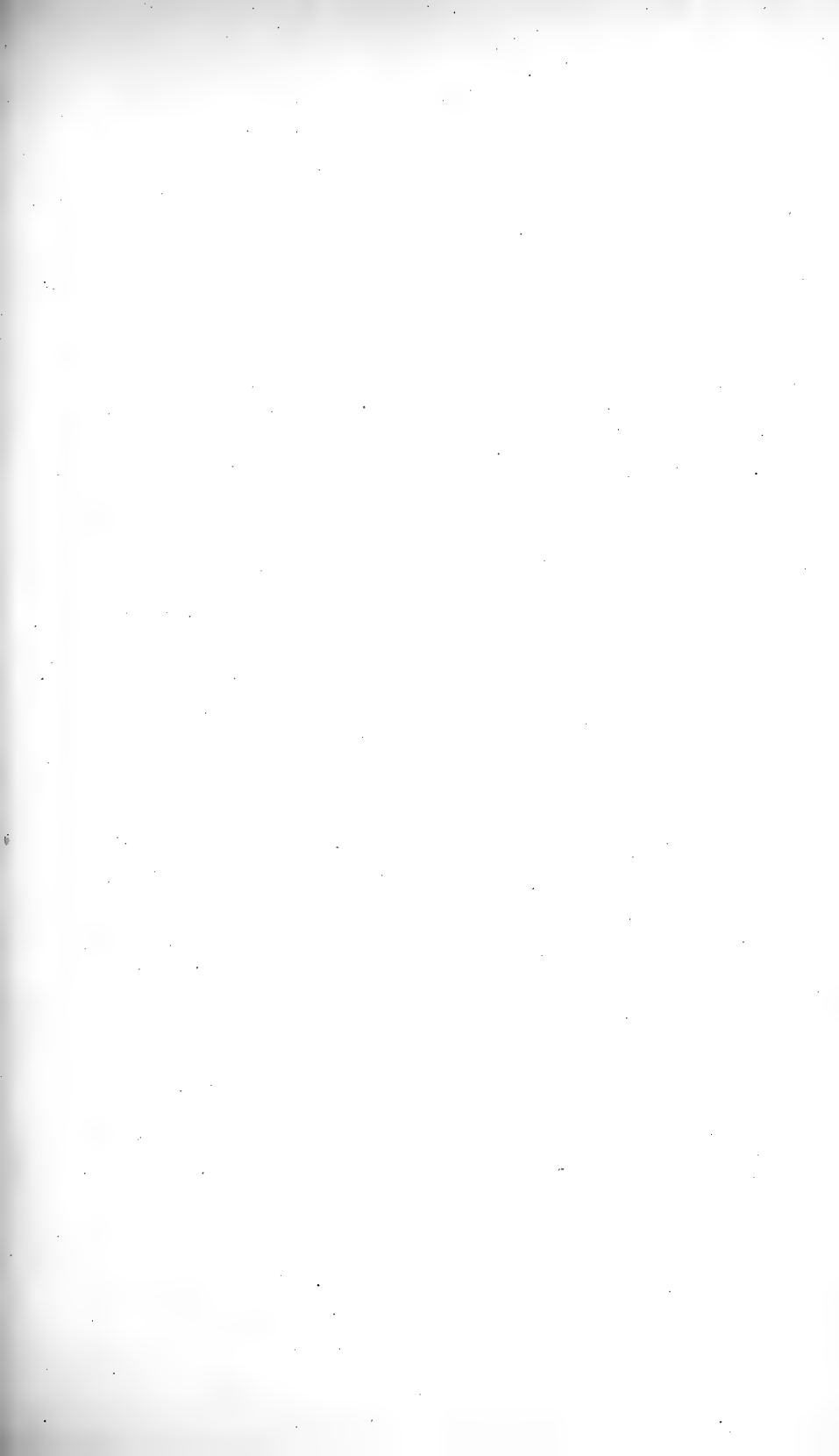
The specimen is somewhat weathered, making the cell pores appear large.

Geological position, Burlington limestone, at Burlington, Iowa.

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<sup>1</sup> δικτυον, net; and ερετμον, an oar.





## EXPLANATION OF PLATE XI.

- FIG. 1. — *Barycrinus hoveyi*. An enlargement of the reproduced portion of the crinoid arm to two diameters.
- FIG. 2. — *Dictyoretmon burlingtonenses*, view of the specimen, natural size.
- FIG. 3. — Enlargement of a portion of the frond to show the arrangements of the cells.
- FIG. 4. — *Onychocardium portlandicum*. Enlargement of a pair of valves as they lie on the rock, 2 X. The left valve is obliquely crushed in the shale so as greatly to distort it.



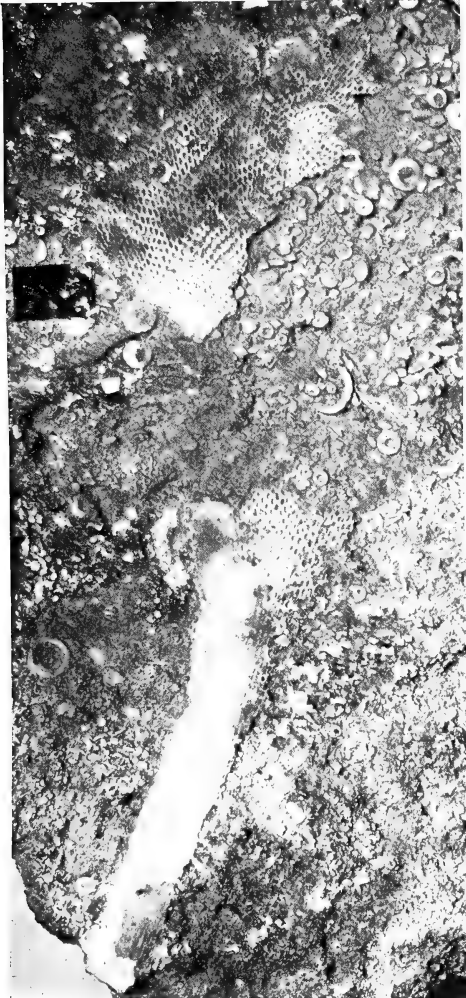
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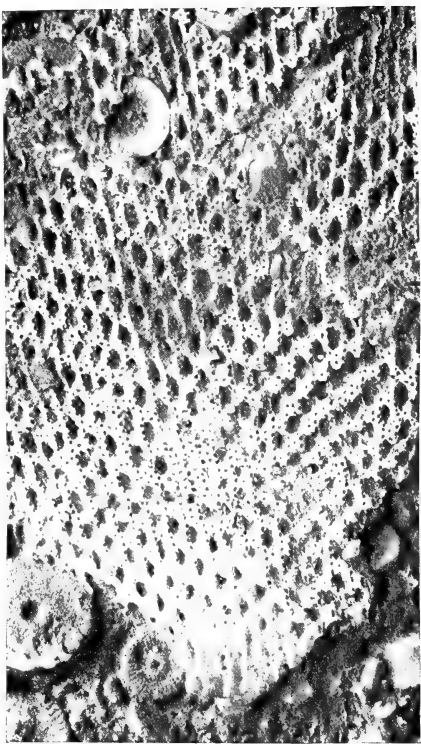
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**Article XXXVII. — NOTICE OF A REMARKABLE CASE  
OF REPRODUCTION OF LOST PARTS SHOWN  
ON A FOSSIL CRINOID.**

By R. P. WHITFIELD.

PLATES XII AND XIII.

A somewhat remarkable case of the reproduction of lost parts has turned up in the arm of a rather fine specimen of *Barycrinus hoveyi* Hall sp., from Crawfordsville, Indiana, in the Museum collection.

The specimen has been in the collection of the Museum for many years (since June, 1880), but with only the calyx and base of a few of the arms showing outside of the block of stone in which it was imbedded, it having been left in this condition in consequence of a specimen of *Onychocrinus* lying obliquely across and above it, which prevented the clearing of the *Barycrinus* from the rock matrix. But in the progress of cataloguing it seemed desirable to separate the two specimens, being of different genera, in order to place them more nearly with their respective forms.

This being safely accomplished it then became possible to free the *Barycrinus* from the rock, in doing which the feature above mentioned was developed. This feature occurs on the middle branch of the right postero-lateral arm, which had been lost during life, above the eighteenth plate from the last true bifurcation of the ray on the upper side of an axial plate, where there would have been an armlet of the second grade produced in the natural course of the growth of the species, but which, together with the entire arm above this point, had been lost.

Upon each upper sloping surface of the axial plate, above mentioned, there has developed a new arm, giving off the usual ramifications, but of much smaller size than those of the broken arm below. The one following in succession to the broken arm plate has a trifle less than half the diameter of the last old arm plate, while on the axial side of the plate the new

production has more the features of the secondary armlets, resembling those below in their granulose-striate texture and in the more slender fimbriate character of the ramifications.

The enlarged figure of this part of the restored arm, accompanying this notice, will give a clearer idea of the feature than will a description.

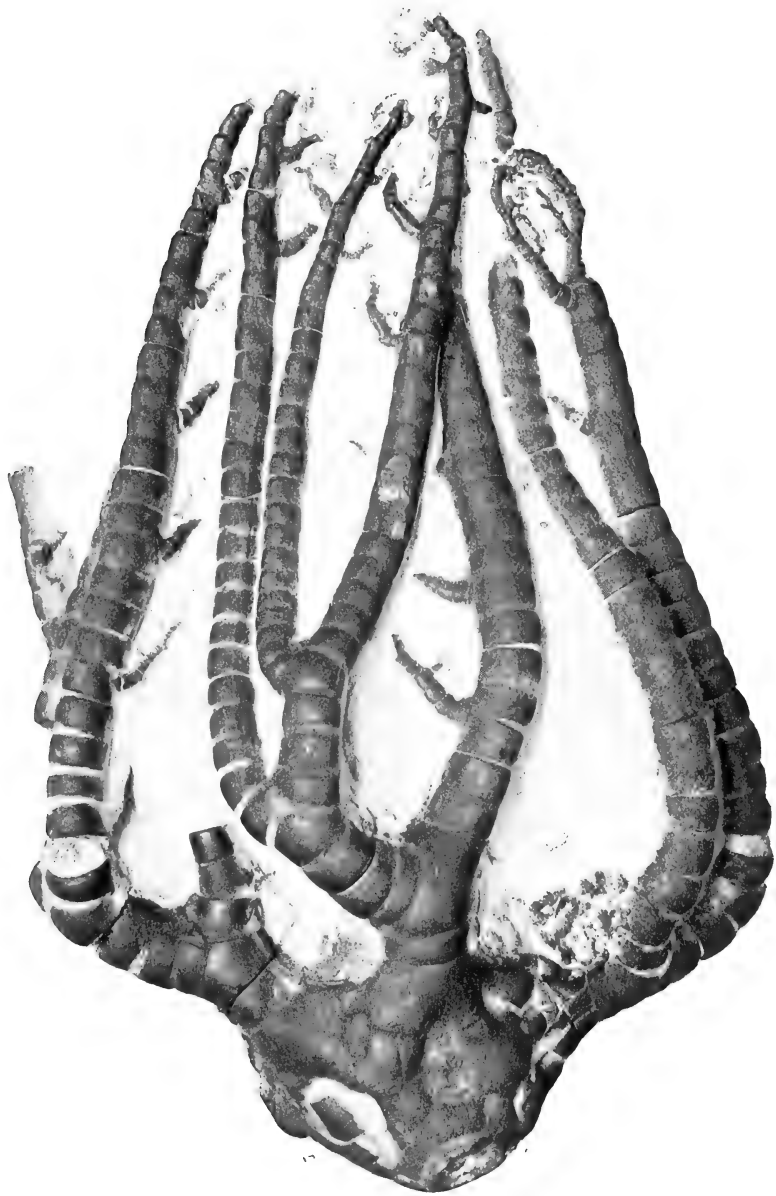
The specimen is from the Keokuk division of the Lower Carboniferous at Crawfordsville, Indiana, and was purchased by the Museum with a collection of fossils in June, 1880.

This feature, of replacing lost parts, is not extremely uncommon among fossil crinoids. I remember two or more instances of Actinocrinoids and Platycrinoids where many of the arms appeared to have been injured or perhaps destroyed, where a healing or reproduction had taken place and where the restored arms were much more slender above the injured point than below. One instance, an example of *Platycrinus striobrachiatus*, a specimen figured on photographic Plate II, distributed to some extent with copies of Professor James Hall's article in the *Journal of the Boston Society of Natural History*, Vol. VII, 1861, pp. 261-328, is now in the collection of the American Museum of Natural History, and shows a break or injury to many of the arms preserved on the specimen, the arms above the injured part being not only considerably smaller than below, but at the break are offset, as if they had been disjunct and had not grown in a direct continuation with the part below. Of twenty-four arms showing on the specimen there are at least ten of them which show something of this irregularity. It is rather a pleasing experience in developing specimens from the rock matrix to come across a feature of this kind, showing that these very ancient organisms possessed this reproducing vitality even as do the related animals of the present day, and that in the ancient seas the more sedentary animals were subjected to injury and reparation as their descendants are to-day.



## EXPLANATION OF PLATE XII.

The anal side of the specimen of *Barycrinus hoveyi*, showing on the upper right-hand side the reproduced part.



ILLUSTRATING REPRODUCTION OF LOST PARTS.







### EXPLANATION OF PLATE XIII.

The opposite side of the specimen shown on Plate XII.



BARYCRINUS HOVEYI *Hall*.



**Article XXXVIII.** — NOTE ON SOME WORM (?) BURROWS IN ROCKS OF THE CHEMUNG GROUP OF NEW YORK.

By R. P. WHITFIELD.

***Arenicolites chemungensis*, sp. nov.**

PLATE XIV, FIGS. 1 AND 2.

While working up the fossils of the Potsdam sandstone for the Wisconsin Report, in 1876 and 1877, there came into my hands a number of specimens representing the so-called *Scolithus*, which I described as *Arenicolites woodi* in Volume IV of Prof. T. C. Chamberlain's Report of 1882. One block of that series showed the original surface of the mud-covered sandstone with the burrows of the worm (?) which made the perforations, together with the little hillocks surrounding the outlet of the burrows, just as the animal built them up by its castings during life; proving pretty conclusively that it must have been a marine worm-like animal which caused the perforations.

Among the geological specimens of the Chemung Group in the Museum, from near Bath, Steuben Co., New York, I find an example so nearly resembling that figured in the Wisconsin Report above referred to, that there can be no question as to the similarity of its origin.

On this Chemung specimen the hillocks are somewhat larger and the funnels more distinct, being generally 5 or 6 mm. in diameter, and the walls surrounding them about 2 mm. thick, while some of the hillocks are much larger and higher and appear to have collapsed from the semifluidity of the sand, closing up the top of the burrow so as to show a mere slit in its place. In a vertical section of the rock the burrows are mostly flattened and often curved as if the sand below prevented, by its compactness, the penetration of the animal below a given depth. Or it may have been that the animal was allied to the recent *Chaetopterus* of our southern coasts, which builds a parchment-like tube, with two openings of a

calcareous structure at some inches apart, with the chitinous tube passing from one to the other some distance below the surface in the sand. This Chemung form I propose to distinguish by the name *Arenicolites chemungensis*.

If this latter view of these curved burrows should be correct, may it not also be true of the curved cast of a burrow figured by Professor James Hall in Pal. N. Y., Vol. II, pl. 31, fig. 7, and referred to as a "fragment of the rib of some vertebrate animal" in the description of the plate and on p. 105, as it occurs in the gray sandstones of the Clinton Group of Central New York?

Geological position, in the Chemung Group, Steuben Co., New York.

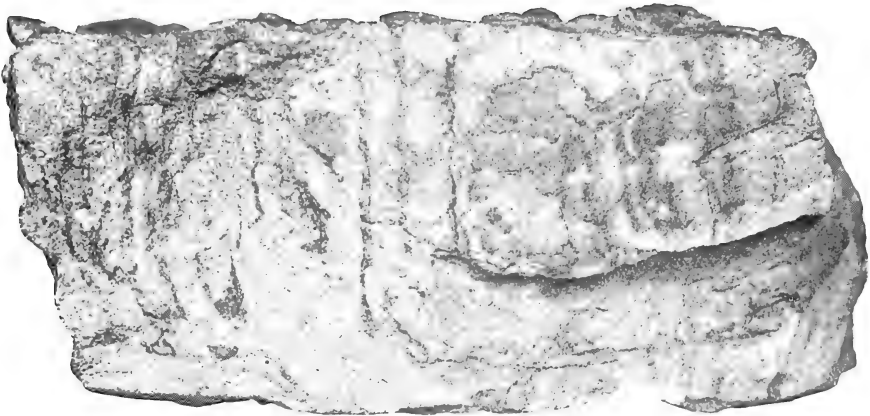


#### EXPLANATION OF PLATE XIV.

FIG. 1. — Shows the surface of the specimen of *Arenicolites che-  
mungensis* described on page 473.

FIG. 2. — View of the edge of the block, showing the vertical burrows  
and the recurving of them in the rock below the surface.





WORM BURROWS.



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# AMERICAN MUSEUM OF NATURAL HISTORY.

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## DEPARTMENT OF VERTEBRATE PALÆONTOLOGY.

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### REVISED LIST<sup>1</sup> OF CASTS, MODELS, PHOTOGRAPHS, AND RESTORATIONS OF FOSSIL VERTEBRATES.

This Department of the American Museum of Natural History was established in May, 1891, as the Department of Mammalian Palæontology, and was extended to include Vertebrate Palæontology in 1896. The object of the Trustees is to procure a representative collection of the American Fossil Vertebrates from the successive geological horizons of the West for purposes of exhibition, research and publication. The collections are being made readily accessible to students, and placed upon exhibition as rapidly as they are prepared. Such duplicate original specimens as are available for purposes of exchange are offered to other museums.

In order to publish as widely as possible the discoveries of scientific and popular interest and to place the knowledge of them within reach of those unable to visit this Museum, a series of plaster casts of specimens and models, and of photographs of skeletons and restorations has been prepared for sale to, or exchange with, other museums, colleges and high schools.

1. *Plaster Casts of Specimens.* — These are from sharp gelatine moulds, of plaster mixed with gum-arabic, strengthened by embedded rods or wires, carefully finished and accurately colored by a skilled artist, so as to be as nearly as possible fac-similes of the original specimens. The price is based on the actual cost of making, and includes coloring and packing, but not transportation charges. The packing

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<sup>1</sup> Revised to January, 1904.

is done in the department, as carefully as possible, but the more delicate casts and models cannot be absolutely guaranteed against breakage.

2. *Models of Extinct Animals.* — These are plaster casts of reduced models (from 1 to 3 feet in length) made by the animal painter and sculptor, Mr. Charles Knight, under direction of Professor Osborn. The casts are made in the same manner as those of specimens and colored under Mr. Knight's personal supervision.

3. *Photographs of Mounted Skeletons of Extinct Animals.* — These are bromide enlargements, 18 x 22 inches, mounted on card, with descriptive labels, from photographs by Mr. Anderson of mounted skeletons in this Museum. These enlargements are not available for purposes of exchange and are sold at \$4.00 each.

4. *Photographs of Restorations of Extinct Animals.* — These are bromide enlargements, 18 x 22 inches, on card, with descriptive labels, from photographs of the series of water-color restorations by Charles Knight. These restorations are drawn from the models above mentioned, and in almost every case based upon a careful study of the complete mounted skeleton, made by Mr. Knight under direction of Professor Osborn, and with advice and assistance of other specialists in Vertebrate Palæontology. The bromides are sold at \$4.00 each and are not available for exchange.

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BASHFORD DEAN		

## I. — CASTS OF ORIGINAL FOSSILS AND TYPES.

Casts Nos. 1 and 2. *Coryphodon testis* (Cope).

## Fore and Hind Feet.

Am. Mus. No. 258.

This large species of *Coryphodon* was the first described from this country, and is second only to *C. anax* in size. The specimens consist of the left fore and hind feet of the same animal. The casts consist of the 52 podial elements colored

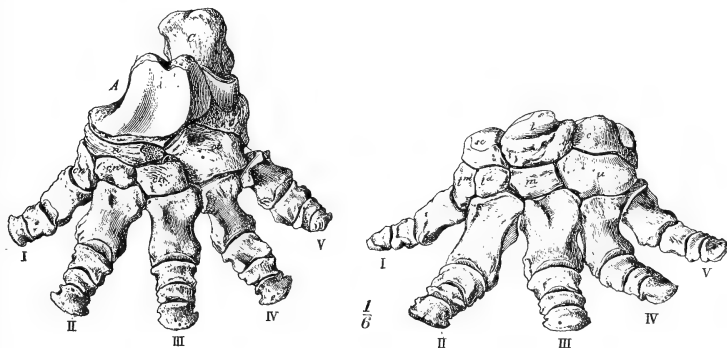


Fig. 1. *Coryphodon testis*. No. 258. Fore and hind feet. One-sixth natural size. Lower Eocene. Wyoming.

and mounted in the natural position upon plaster blocks imitating the matrix. Each piece is complete and can be studied separately.

Price, \$20.

*Coryphodon radians* COPE, OSBORN & WORTMAN, Fossil Mammals of the Wahsatch and Wind River Beds, Bull. Am. Mus. Nat. Hist., 1892, Vol. IV, p. 119; OSBORN, A Mounted Skeleton of *Coryphodon radians*, *ibid.* Vol. X, pp. 81-91.

*Coryphodon testis* (COPE) OSBORN, Evolution of the Amblypoda, Bull. Am. Mus. Nat. Hist., 1898, Vol. X, pp. 189-205.

No. 3. *Palæosyops major* Leidy.

## Fore Foot.

Am. Mus. No. 1544.

Cast from the foot of the complete skeleton mounted in the American Museum. This is the characteristic Titanotheres of

the Middle Eocene Period (Bridger and Washakie). The foot bones are not cast separately.

The especial interest of the Titanotheres fore foot is that it is essentially paraxonic (Artiodactyl) although belonging to a member of the Perissodactyla, with a typically Perissodactyl (mesaxonic) pes. Several other Artiodactyl characters are found in this family, supporting Cope's contention that the Perissodactyla and Artiodactyla should be united in a single order (Diplarthra).

Price, \$5.

**Nos. 4 and 5. *Diplacodon emarginatus* Hatcher.**

**Front of Skull and Lower Jaw.**

Cast, by courtesy of the Princeton University Museum, from the type specimen described by Hatcher.

It shows the intermediate stage in the development of the horns between the ancestral Titanotheres of the Middle Eocene, hornless or with very rudimentary horns (*Palæosyops* and *Telmatotherium*), and the horned species (*Titanotherium*) of the Oligocene. The greatest diameter of the horns is antero-posterior, and both the nasals and frontals enter to some degree into the base. *Diplacodon* is found in the Upper or True Uinta Beds of the Upper Eocene.

Price, \$15.

HATCHER, On a New Species of *Diplacodon*, Am. Nat., 1895, p. 1084, pl. xxxviii.

**No. 6. *Dromatherium sylvestre* Emmons.**

**Type Lower Jaw.**

Cast, by courtesy of the Geological Museum of Williams College, from the original.

This classic specimen is the better preserved of the two jaws found by Prof. Ebenezer Emmons in 1854 in the Triassic Coal Beds of Egypt, North Carolina. It is distinguished from the jaw of a reptile by apparently consisting of a single bone, while the teeth begin to show two fangs and multiple cusps prophetic of the mammal type, the Protodonta of Osborn.

Price, \$3.

EMMONS, American Geology, Part VI, p. 93.

OSBORN, Proc. Acad. Nat. Sci. Phila., 1886, p. 359.

**No. 7. *Micronodon tenuirostris* Osborn.**

**Type Lower Jaw.**

Cast, by courtesy of the Philadelphia Academy of Natural Sciences, from the original there preserved.

This specimen, referred by Emmons to *Dromatherium sylvestre*, was shown by Osborn in 1886 to present important differences, and made the type of a new genus and species. The specimen is so small that the cast is not very perfect in detail.

Price, \$3.

**No. 8. *Periptychus rhabdodon* (Cope).**

**Brain Cast.**

Am. Mus. No. 3665.

*Periptychus*, the most abundant quadruped of the Basal Eocene Torrejon Formation, presents a very small brain resembling that of a rabbit.

Price, \$1.

**No. 9. *Pantolambda bathmodon* Cope.**

**Brain Cast.**

Am. Mus. No. 3957.

The brain of *Pantolambda* was very similar to that of its contemporary *Periptychus*, and gives us the early Amblypod type, ancestral to that of *Coryphodon* and *Uintatherium*.

Price, \$1.

**10. Giraffe-Camel. *Alticamelus altus* (Marsh).**

**Hind Limb.**

Am Mus. No. 9109.

Upper Miocene (Loup Fork) of Colorado, Am. Mus. Expedition, 1898.

Cast from the hind limb of the specimen in the American Museum Collection. This animal, although a true Camel,

simulated the Giraffe in the extreme elongation of the neck and legs, and equalled it in size, the hind limb being over seven feet long. It is a most instructive example of parallelism, as well in its points of difference from the Giraffe as in the resemblances.

Price, \$12.

MATTHEW, Mem. Am. Mus. Nat. Hist., Vol. I, Pt. vii, 1901, p. 429, pl. xxxix.

## II. *Dissacus saurognathus* Wortman.

### Lower Jaw.

Am. Mus. No. 2454. Type specimen.

*Dissacus* was the largest and one of the most characteristic Creodonts of the Torrejon horizon of the Basal Eocene. It is believed to have been the direct ancestor of the great *Mesonyx*

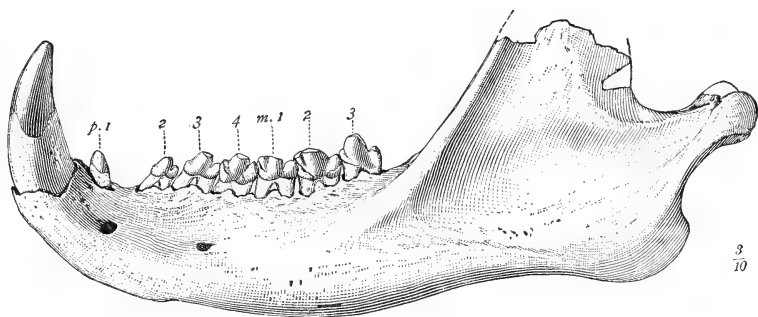


Fig. 2. *Dissacus saurognathus*. Lower jaw. Basal Eocene (Torrejon or Upper Puerco) New Mexico. Three tenths natural size.

of the Middle and Upper Eocene. This very perfect lower jaw, sixteen inches long, is the best specimen of the large species.

Price, \$8.

MATTHEW, Bull. Am. Mus. Nat. Hist., 1897, p. 286, fig. 9.



**12. Polymastodon taöensis Cope.**

**Lower Jaws.**

Am. Mus. No. 968.

A pair of complete rami of the lower jaw. The Multituberculates, a characteristic group of Mesozoic time, reached their culmination in the Puerco or lower horizon of the Basal Eocene, in this species, about the size of a Beaver. The true position of this group of pseudo-rodents is uncertain; they are generally considered, though on very insufficient evidence, to be related to the modern Monotremata.

*Price, \$6.*

OSBORN & EARLE, Bull. Am. Mus. Nat. Hist., 1895, p. 13, fig. 1c.

**13. Polymastodon attenuatus Cope.**

**Upper Teeth.**

Am. Mus. No. 970.-

The incisors of one side and premolars and molars of both sides, set in plaster.

*Price, \$3.*

OSBORN & EARLE, Bull. Am. Mus. Nat. Hist., 1895, p. 13, fig. 1b.

**14. Palæonictis occidentalis Osborn & Wortman**

**Lower Jaws and Front of Skull.**

Am. Mus. No. 110. Type specimen.

From the Suessonian (Wasatch) of Wyoming.

This rare and fine specimen, found by Wortman in 1891, supplies another proof of the homotaxy of the Wasatch with the Suessonian of Europe, where the genus is represented by the less perfect specimens preserved in the Paris Museum.

*Price, \$12.*

OSBORN & WORTMAN, Bull. Am. Mus. Nat. Hist., 1892, p. 104, pl. iv.

**15. Carnivorous Dinosaur, *Allosaurus*.****Hind Limb Complete.**

Am. Mus. No. 290.

Upper Jurassic (Atlantosaurus or Como beds) of Wyoming, Expedition of 1898.

The limb is seven feet two inches high, as mounted in the natural position, and is almost absolutely complete, the distal



Fig. 3. *Allosaurus* hind limb, from Upper Jurassic of Bone Cabin Quarry, Wyoming.

parts of the fourth digit being perfect, the proximal splint only wanting. Each bone is cast separately—twenty-four pieces in all.

Price, \$40.

OSBORN, Bull. Am. Mus. Nat. Hist., 1899, p. 161, figs. 1-4a.

**16. *Patriofelis ferox* (Marsh).****Fore and Hind Feet.**

Am. Mus. No. 1507.

Original from the Bridger or Middle Eocene of Wyoming, Expedition of 1893.

Typical Creodont or Primitive Carnivore foot. Taken from the mounted skeleton in the American Museum Collection.

Displays the broad, spreading foot with blunt, hoof-like claws and very limited play on the joints, common to most of the larger Creodonts. The hind foot is nine inches long.

Price, \$10.

OSBORN, *Patriofelis* and *Oxyæna* Re-studied as Terrestrial Creodonts, Bull. Am. Mus. Nat. Hist., XIII, 1900, pp. 269-279.

WORTMAN, Osteology of *Patriofelis*, Bull. Am. Mus. Nat. Hist., VI, 1894, pp. 129-164.

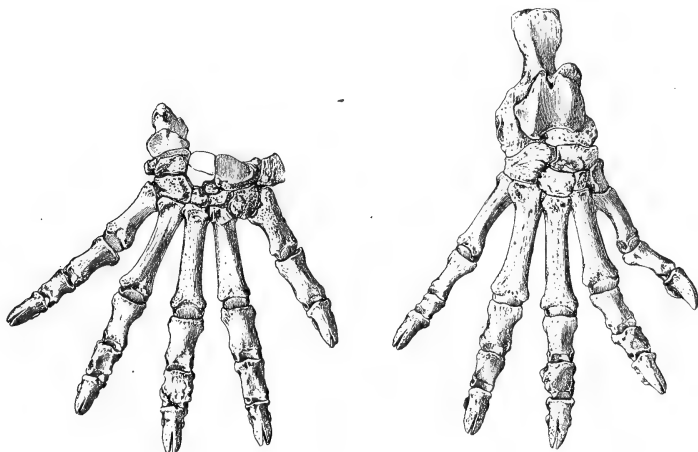


Fig. 4. *Patriofelis ferox* (Marsh). Fore and hind feet. One-fourth natural size.

### 17-20. Type Specimens of Eocene Tapiroids.

	PRICE.
17. <i>Desmatotherium guyoti</i> , upper jaws, type.....	\$1.00
18. <i>Dilophodon minusculus</i> , lower jaw, type.....	1.00
19. <i>Isectolophus latidens</i> , jaw fragments, types.....	1.50
20. <i>Isectolophus annectens</i> , jaw fragments, types.....	1.50

Four little-known Tapiroid mammals from the Bridger and Uinta Eocene of Wyoming. The originals are in the Princeton Museum.

SCOTT, *Desmatotherium* and *Dilophodon*, Contributions from the Museum of Princeton College, 1883, p. 51, pl. viii.

SCOTT & OSBORN, The Mammalia of the Uinta Formation, Trans. Amer. Philos. Soc., 1889, pp. 519, etc.

**21. *Heptodon calciculus* Cope.****Palate and Complete Lower Jaws.**

Amer. Mus. No. 294.

Primitive Lophiodont from the Wind River Eocene of Wyoming. Probably ancestral to the *Colodons* of the American Oligocene.

Price, \$7.

OSBORN & WORTMAN, Fossil Mammals of the Wasatch and Wind River Groups, Collection of 1891, Bull. Amer. Mus. Nat. Hist., IV, 1892, p. 127.

**22. *Colodon dakotensis* Osborn & Wortman.****Upper Jaws.**

Am. Mus. No. 1212.

White River Oligocene, S. Dakota.

Price, \$3.

**23. *Colodon occidentalis* (Leidy).****Lower Jaws and Fore Foot.**

Am. Mus. No. 658.

White River Oligocene, S. Dakota.

This rare Lophiodont is known only by fragmentary specimens. The group is intermediate between Tapirs and Horses in some respects, between Tapirs and Rhinoceroses in others. It left no descendants.

Price, \$5.

OSBORN & WORTMAN, Perissodactyls of the Lower Miocene White River Beds, Bull. Amer. Mus. Nat. Hist., VII, 1895, p. 362, fig. 7.  
WORTMAN & EARLE, Ancestors of the Tapir from the Lower Miocene of Dakota, Bull. Amer. Mus. Nat. Hist., V, 1893, p. 174, figs. 6 and 7.

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24. *Systemodon primævus* Wortman.

Palate and Lower Jaw.

Am. Mus. Nos. 144 and 131.

Suessonian (Wasatch Beds) Wyoming.

*Systemodon* is the starting point, as far as known, of the Tapir line, and strikingly resembles in most respects the contemporary ancestors of the Horse (*Hyracotherium*, etc.).

Price, \$4.

OSBORN & WORTMAN, Fossil Mammals of the Wasatch and Wind River Beds, Collection of 1891, Bull. Amer. Mus. Nat. Hist., IV, 1892, p. 125, fig. 17.

WORTMAN, Species of *Hyracotherium*, etc., Bull. Amer. Mus. Nat. Hist., VIII, 1896, p. 87, fig. 3.

25. *Protapirus validus* Hatcher.

Skull.

Type specimen (Original in Princeton Museum).

Protoceras Beds, White River Formation (Oligocene), S. Dakota.

Price, \$7.

HATCHER, Recent and Fossil Tapirs, Amer. Jour. Sci., I, 1896, p. 162, pl. ii.

26. *Protapirus obliquidens* Wortman & Earle.

Lower Jaws and Fore Foot.

Am. Mus. Nos. 661 and 662.

Protoceras Beds, White River Formation (Oligocene), S. Dakota.

*Protapirus* is intermediate between the modern Tapirs and their primitive Eocene ancestors (*Systemodon* and *Isectolophus*).

Price, \$6.

WORTMAN & EARLE, Ancestors of the Tapir from the Lower Miocene of Dakota, Bull. Amer. Mus. Nat. Hist., V, 1893, p. 165, figs. 2, 3, 4.

**27. *Oreodon culbertsoni* Leidy.****Fore and Hind Foot.**

Am. Mus. No. 1287. Cast from the mounted skeleton in the American Museum.

Oreodon Beds, White River Formation (Oligocene), S. Dakota.

Shows a very primitive Artiodactyl foot, the fore foot still retaining a rudimentary thumb, and the lateral digits being less reduced than in any of the more recent Artiodactyls.

Price, \$6.

SCOTT, W. B., Beiträge zur Kenntniss der Oreodontidæ, Morph. Jahrb., 1890, pp. 328, 334, pl. xvi, figs. 27, 28.

**28. *Hyænodon horridus* Leidy.****Fore and Hind Foot.**

Am. Mus. No. 1375. Cast from the mounted skeleton in the American Museum.

Oreodon Beds, White River Formation (Oligocene), S. Dakota.

*Hyænodon* was the latest and most specialized of the Creodonts or Primitive Carnivores, and the feet are adapted for running, although not so well as in the modern swift-footed Carnivora.

Price, \$7.

SCOTT, W. B., The Osteology of *Hyænodon*, Journ. Acad. Nat. Sci. Phila., Vol. IX.

**29. Series of Fossil Horse Feet.****Illustrating the Evolution of the Horse.**

The Horses afford the best illustration of the evolution of a race of animals during geological time, commencing in the Lower Eocene as small fox-like animals with several toes on each foot, and ending with the modern Horses, Asses, and Zebras. At least ten intermediate stages are known in the direct line of descent, besides several stages of collateral branches, leading into types which have left no modern descendants. Those of which casts are now ready are:

Stage *b*.—*Hyracotherium craspedotum*. Fore and hind feet. Middle Eocene (Wind River), Wyoming. Four toes and a rudiment of a fifth (1st digit) on the fore foot, three toes on the hind foot. Size of a fox. Price, \$4.

Stage *e*.—*Meshippus bairdi*. Fore and hind feet. Lower Oligocene (White River), S. Dakota. Three toes on fore and hind foot, the fourth (5th digit) represented on the fore foot by a short "splint-bone." Lateral toes much reduced, but still touching the ground. Size of a prairie wolf. Price, \$4.

Stage *f*'.—*Meshippus intermedius*. Fore and hind feet. Upper Oligocene (White River, Protoceras Beds), S. Dakota. Like *M. bairdi*, but larger. Price, \$5.

Stage *f*".—*Meshippus copei*. Hind foot. Upper Oligocene (White River, Protoceras Beds), S. Dakota. Larger than *M. intermedius*. Price, \$3.

Stage *h*".—*Hyphippus equinus*. Fore and hind feet. No. 8407. Middle Miocene (Loup Fork), Colorado. Larger than any of the preceding species; size of Shetland pony. Fifth digit of the fore foot reduced to a little nodular rudiment. Side toes still touch the ground. Price, \$12.

Stage *i*".—*Merychippus sejunctus*. Fore and hind feet. Middle Miocene, Colorado. Fifth digit of fore foot a small nodular rudiment, side toes much reduced, not reaching the ground. Size of 3-months-old colt. Price, \$10.

Stage *j*".—*Neohipparion whitneyi*. Fore and hind feet. Upper Miocene (Loup Fork), S. Dakota. Feet and limbs elongate, proportions like those of the deer. Side toes more reduced than in *Merychippus*, size somewhat larger. Price, \$12.

### 30. Series of Fossil Horse Skulls.

#### Illustrating the Evolution of the Horse.

(Stages corresponding with those in No. 29.)

Those now ready are:

Stage *c*.—*Protorhippus venticolus*. Crushed skull and jaws. No. 4832. From mounted skeleton in Cope Collection. Middle Eocene (Wind River), Wyoming. Short-crowned teeth of primitive pattern. Size of fox. Price, \$4.

Stage *e*.—*Mesohippus bairdi*. Skull and jaws. No. 1477. From Lower Oligocene (Oreodon Beds, White River), Nebraska. Short-crowned teeth of more horse-like pattern. Size of prairie wolf. Price, \$8.

Stage *h*".—*Hypohippus equinus*. Skull and jaws. No. 8407. From Middle Miocene (Loup Fork) of Colorado. Teeth much like those of *Mesohippus*. Size of Shetland pony. Price, \$15.

Stage *i*".—*Merychippus sejunctus*. Skull and jaws. No. 8291. Cope Collection. Middle Miocene (Loup Fork) of Colorado. Long-crowned teeth with cement. Pattern intermediate between *Mesohippus* and *Equus*. Size of 3-months-old colt. Price, \$15.

### 31. *Pantolambda bathmodon* Cope.

#### Fore and Hind Feet.

From mounted skeleton in American Museum. No. 2549.

Torrejon Formation (Basal Eocene) of New Mexico.

Primitive ungulate foot, with five toes, first digit semi-opposable, plantigrade step, wide, loosely joined wrist and ankle-bones (giving much flexibility in all directions at the expense of power), and other characters now preserved chiefly among arboreal mammals. The foot approaches nearly those of the more ancient unguiculates or clawed animals. *Pantolambda* was ancestral to the ancient *Amblypoda* (*Coryphodon* and *Uintatherium*), but only a collateral ancestor of the more recent hoofed animals.

Price, \$5.

OSBORN, Evolution of the Amblypoda, Bull. Am. Mus. Nat. Hist., X, 1898, pp. 183-188, figs. 9, 10, 12.

### 32. Series of Fossil Camel Feet.

#### Illustrating the Evolution of the Camels and Llamas.

Although now found only in the desert regions of Asia, Africa, and South America, the Camel family was of North American origin, spreading to other continents only in the Pliocene epoch, and becoming extinct in its original home



during the Pleistocene. During the Tertiary the race evolved from small deer-like animals, no larger than jack-rabbits, with sharp, pointed hoofs and separate metapodial bones, to their present size and proportions, the metapodials becoming solidly fused together and a large pad on the foot supporting the weight of the body. Collateral lines of descent also existed, one ending in an animal of singularly giraffe-like proportions, although a true Camel (Giraffe-Camel, see also No. 10, on page 5).

Stage a. — *Protylopus petersoni*. Hind limb. No. 2564. Upper Eocene (Uinta), Utah. Separate metapodials, lateral digits represented by short splints, pointed hoofs. Size of jack-rabbit. Price, \$5.

Stage b. — *Poebrotherium wilsoni*. Fore and hind feet. No. 1364. Lower Oligocene (White River), S. Dakota. Separate metapodials, lateral digits represented by small nodular rudiments, pointed hoofs. Size of vicuña. Price, \$5.

Stage e'. — *Protolabis montanus*. Fore and hind feet. No. 9108. Middle Miocene (Loup Fork), Colorado. Separate metapodials, lateral rudiments fused, hoofs pointed. Size of llama. Price, \$6.

Stage f". — *Alticamelus altus*. (Giraffe-Camel.) Hind limb. No. 9109. Middle Miocene (Loup Fork), Colorado. United metapodials, greatly elongated, hoofs considerably reduced. Size of small giraffe. Price, \$12.

### 33. *Protoceras celer* Marsh.

#### Fore and Hind Foot.

Protoceras Beds, White River Oligocene, S. Dakota.

*Protoceras* is the largest of a peculiar group of primitive ruminants characteristic of the White River Oligocene. The fore foot has four fully functional digits, but in the hind foot the lateral digits are reduced to small splints. The animal was somewhat smaller than the musk deer, much less

gracefully proportioned, the skull remarkably specialized in the male.

Price, \$5.

SCOTT, Osteology and Relations of *Protoceras*, Jour. Morph., Vol. XI.  
OSBORN & WORTMAN, Characters of *Protoceras*, etc. Bull. Amer.  
Mus. Nat. Hist., IV, 1892, pp. 351-372.

### 34. Type Specimens of Fossil Equidæ.

	PRICE.
<i>Equus complicatus</i> Leidy. Upper molar. Pleistocene.....	\$2.00
“ <i>excelsus</i> Leidy. Upper jaw. “ .....	4.00
“ <i>occidentalis</i> Leidy. Upper molars. “ .....	2.00
“ <i>pectinatus</i> Cope. Upper teeth, series. “ .....	5.00
<i>Hipparion speciosum</i> Leidy. Upper teeth. Miocene.....	3.00
“ <i>affine</i> Leidy. “ “ .....	3.00
“ <i>occidentale</i> Leidy “ “ .....	3.00
“ <i>gratum</i> Leidy “ “ .....	2.50
“ <i>montezumæ</i> Leidy. Upper and lower tooth. Mio- cene.....	2.00
<i>Merychippus mirabilis</i> Leidy. Upper jaw. Miocene.....	3.00
“ <i>insignis</i> Leidy. “ “ .....	3.00
<i>Parahippus cognatus</i> Leidy. Upper teeth, “ .....	2.50
<i>Parahippus (Desmatippus) crenidens</i> Scott. Upper and lower jaws. Miocene.....	6.00
<i>Anchippus texanus</i> Leidy. Upper molar. Miocene.....	1.50
<i>Hypohippus affinis</i> Leidy. “ “ .....	1.50
<i>Hypohippus (Anchitherium) equinus</i> . Upper and lower jaws. Miocene.....	6.00
<i>Mesohippus bairdi</i> Leidy. Figured skull and jaws. Leidy, 1869, pl. xx. Oligocene.....	5.00

The patterns of the molars in the above type specimens have been copied with especial care and accuracy on the casts.

### 35. *Phenacodus primævus* Cope.

#### Fore and Hind Feet.

Wasatch Formation, Lower Eocene, Wyoming.

The mounted skeleton of *Phenacodus* in the Cope Collection (now in the American Museum) is well known by descriptions

and figures in all textbooks of geology and palæontology. *Phenacodus* is the type of the Condylarthra, a very archaic order of ungulates retaining the primitive form of wrist and ankle articulations, five toes on each foot, and pig-like teeth, and considered to represent very nearly the central prot-ungulate type from which all hoofed animals are descended. The size of *P. primævus* was somewhat less than that of a pig.

Price, \$10.

COPE, E. D., Tertiary Vertebrata, Rep. U. S. G. S. Terrs., Vol. III, B'k I, p. 435, and plates.

OSBORN, H. F., Remounted Skeleton of *Phenacodus*, Bull. Am. Mus. Nat. Hist., X, 1898, pp. 159-164.

### 36. *Euprotogonia puercensis* (Cope).

#### Hind Foot.

Torrejon Formation, Basal Eocene, New Mexico.

*Euprotogonia* was the ancestor of *Phenacodus*, and has a still more primitive type of foot. The five toes are tipped with narrow, claw-like hoofs, and in other characters this foot is

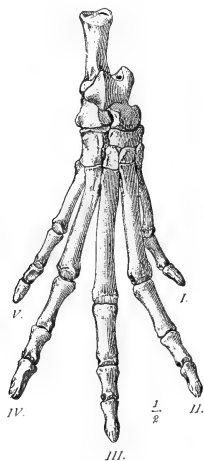


Fig. 5. *Euprotogonia puercensis*.  
Hind foot. One-half natural size.

intermediate between the hoofed animals (Ungulata) and clawed animals (Unguiculata), and indicates the derivation

of both from a common ancestor. This species was about the size of a cat, and the cast is taken from an incomplete skeleton in the American Museum.

Price, \$4.

MATTHEW, Revision of the Puerco Fauna, Bull. Amer. Mus. Nat. Hist., XI, 1897, p. 305, fig. 12.

OSBORN, Remounted Skeleton of *Phenacodus*, Bull. Amer. Mus. Nat. Hist., X, 1898, p. 159.

### 37. *Stereosternum tumidum* Cope.

#### Skeleton.

Upper Permian, near São Paulo, Brazil.

This beautifully preserved skeleton is one of the most ancient and primitive reptiles known, and represents a distinct and very primitive order of Reptilia, the *Proganosauria*, with many characters connecting it with the Amphibia. Skeleton in block, about two feet long, showing all parts except the left fore and hind feet, and with the outlines of the body indicated. By courtesy of the Director of the Geological Survey of Brazil.

Price, \$15.

COPE, Contribution to the Vertebrate Palæontology of Brazil, Proc. Am. Phil. Soc., XXIII, 121, 1885; The Carboniferous Genus *Stereosternum*, Amer. Nat., 1887, 1109.

OSBORN, Memoirs Am. Mus. Nat. Hist., Vol. I, Pt. VIII, p. 481, figs. 15-19, and pl. xl, Nov., 1903.

## II.—CASTS OF MODELS OF EXTINCT VERTEBRATES BY CHARLES KNIGHT.

*Originals presented by J. Pierpont Morgan, Esq.*

### No. 1. Three-horned Frill-necked Dinosaur. *Triceratops prorsus* Marsh.

The original model was made by Mr. Knight for the National Museum, under direction of Mr. Lucas, and is based on parts of several skeletons there preserved.

*Triceratops* was one of the last and most remarkably specialized of the Dinosaurs. It was herbivorous, quadrupedal, with elephant-like legs and feet. The skull was of huge size, 6-8 feet long, with long, powerful horns projecting forward, and a great bony frill projecting backward and completely covering the neck. One-tenth natural size. Length of base, 18 inches.

Price, \$20.

**No. 2. The Duck-billed Dinosaur. *Hadrosaurus mirabilis*  
*Leidy.***

The model of this remarkable Dinosaur is based on an almost complete specimen in the Cope Collection, now in this Museum, which will shortly be placed on exhibition as a mounted skeleton. It was found in the Laramie Cretaceous by Messrs. Wortman and Hill, and described by Professor Cope (under the generic name *Diclonius*) in 1883. The animal was thirty feet in length, with a long neck, flattened, duck-like bill, numerous small teeth, small fore limbs, and heavy hind limbs and tail. It was probably of amphibious habits, feeding on soft water-plants. It was covered with a thick, rhinoceros-like hide, parts of which are preserved in Professor Cope's specimen. One-eleventh natural size; length of base, 12 inches.

COPE, Proc. Acad. Nat. Sci. Phila., 1883, p. 97; Am. Nat., 1883, p. 774.

Price, \$10.

**No. 3. Leaping Carnivorous Dinosaur. *Dryptosaurus (Laelaps) aquilunguis* Cope.**

The first Dinosaur described by Professor Cope was *Laelaps aquilunguis* from the New Jersey Cretaceous beds. The model is based upon this fragmentary skeleton and upon the restoration by Professor Marsh of the allied form *Ceratosaurus*.

The Carnivorous Dinosaurs, although smaller than some of the herbivorous kinds, were animals of great size. This species

was about fifteen feet long. According to Professor Cope's views, by which Mr. Knight was chiefly guided in making this and the following restoration, the animal was an active and powerful leaper, and the model, representing two fighting *Laelaps*, carries out this conception. One-seventh natural size. Length of base, 18 inches.

COPE, Proc. Acad. Nat. Sci. Phila., 1866, p. 275; Proc. Amer. Philos. Soc., XXX, p. 240, May, 1892.

MARSH, Dinosaurs of North America, pp. 157-163, pl. xiv.

Price, \$20 (2 figures, complete).

#### No. 4. *Naosaurus claviger* Cope.

From the Permian Beds of Texas. This belongs to the primitive Reptilian order *Pelycosauria* of Cope, but represents a highly specialized side-branch, related to the *Rhynchocephalia* or *Proganosauria* as shown by Baur and Case. The precise object of the extraordinary rigid fin on the back is not known; it was humorously suggested by Cope that it might have been used as a sail. It was, perhaps, chiefly ornamental. Different species of Naosaurs reach from three to ten feet in length, and the dorsal fin reaches a length even greater than that shown in the model. One-fifth natural size. Length of base, 12 inches.

COPE, Proc. Amer. Phil. Soc., 1878, p. 510, and subsequent papers.

BAUR & CASE, Morphology of the Skull of the Pelycosauria, Anatom. Anzeiger, Bd. XIII, p. 109, Jena, 1897.

Price, \$12.

#### No. 5. *Cervalces americanus* (Harlan).

This Pleistocene American Elk was of the size and proportions of the living Moose, but had horns almost as large as those of the Extinct Irish Deer of Europe, and expanded in three planes of growth at right angles to each other. The model is based on a remarkably perfect skeleton found in New Jersey and mounted in the Princeton University Museum.

This skeleton was fully described by Professor Scott, in 1885, as possessing characters intermediate between those of the

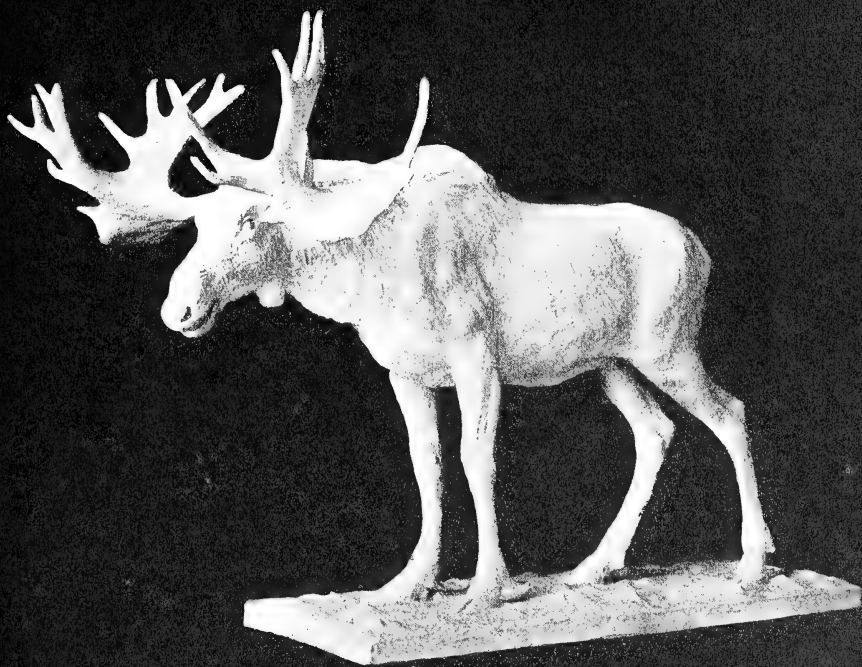


Fig. 6. *Cervalces americanus*. Modelled by Charles Knight from the fossil skeleton in Princeton Museum.

deer and" moose. One-fourth natural size. Length of base, 24 inches.

SCOTT, Proc. Acad. Nat. Sci. Phila., 1885, p. 191.

Price, \$30.

**No. 6. Long-horned Titanotheres. *Brontotherium platyceras* (S. & O.).**

Based on the mounted skeleton and skulls in the American Museum, and on the monographic studies of the Titanotheres by Professor Osborn.

The model represents a charging Titanotheres, and illustrates a chief use of the great horns developed in these animals. One-eighth natural size. Length of base, 25 inches.

Price, \$20.

#### No. 7. Series of Heads of Titanotheres.

This series of five heads represents the evolution and polyphyletic development of the Titanotheres during the Lower Oligocene.

- a. *Brontotherium platyceras*,
- b. *Megacerops robustus*,
- c. *Titanotherium ingens*,
- d. *Symborodon acer*,
- e. *Diplacodon emarginatus*.

One-sixth natural size.

Price, \$5 each; for the set, \$20.

#### No. 8. Restored Head of Dinocyon. *Dinocyon gidleyi* Matthew.

Upper Miocene Epoch, Texas. One-fourth natural size.

Based on the skull and jaws in the American Museum. This gigantic dog equalled the polar or Kadiak bear in size, and resembled them in many external characters. One-fourth natural size.

Price, \$5.

#### No. 9. Sabre-tooth Tiger. *Smilodon*.

This restoration model is based on a complete mounted skeleton of *S. necator* in the American Museum.

*Smilodon*, of the Pleistocene epoch, was the latest and largest of the Sabre-tooth Tigers, equalling a polar bear in size, and provided with canines which projected seven inches from the jaw. It ranged through the New World from Canada to Patagonia, and probably preyed on the great ground sloths or other gigantic herbivora of the Tertiary Period, to pierce whose thick hide and heavy fur the enormous canines were well adapted. One-sixth natural size. Length of base, 14 inches.

Price, \$15.



## III. — PHOTOGRAPHS OF MOUNTED SKELETONS.

*Bromide enlargements from the original negatives. Size,  
18 in. x 22 in.*

These photographs are taken from the fossil vertebrates in the American Museum, as an exhibition of the Succession of Vertebrate Life in North America. Other skeletons are in various stages of preparation, photographs of which will be added to this series.

The skeletons show the actual form, proportions, and attitudes of these extinct animals as nearly as they can be determined or the preservation of the specimen permits.

The photographs also exhibit the different methods employed in mounting, each method being adapted to the special condition of the fossil. For example, *Cænopus tridactylus*, No. 11, and *Tylosaurus*, No. 14, are cases where a LOW RELIEF mounting was necessary. *Amynodon*, No. 18, is an instance of the HIGH RELIEF mounting. In some cases the matrix is wholly or partly the original rock in which the fossil was found; in others it is a close imitation of it, made partly by mingling the rock with plaster, thus giving the visitor and student a truer conception of the original embedding. Other animals are mounted in FULL RELIEF, like a recent skeleton, with the aid of concealed, or partly concealed, iron rods. Except when abundant duplicate material is available, each bone is made easily removable for purposes of study, fastened to its mountings by wire ties or by concealed screws and bolts. The mounting is under the direction of the Curator and of Mr. Adam Hermann, Preparator.

*Price of the photographs, \$4 each.*

1. *Metamynodon planifrons* Scott & Osborn.

Am. Mus. No. 546.

This aberrant rhinoceros of the Oligocene epoch was discovered by Garman and described by Scott and Osborn in 1887. The mounted skeleton is a composite from materials obtained by the Amer. Mus. Expeditions of 1892 and 1894 in

the Big Badlands of South Dakota. Its length is 9 ft. 7 inches. The general impression is of a very broad, flat skull, with formidable canine tusks; small, but prominent and greatly elevated eye-sockets, and a very broad chest. The fore and hind limbs are quite powerful, but the metapodials are rather slender, especially in the manus. This animal is widely separated from the true Rhinoceros by its four completely functional digits on the fore foot and by the strong development of the canines.

OSBORN & WORTMAN, *Perissodactyls of the Lower Miocene, White River Beds*, Bull. Am. Mus. Nat. Hist., VII, 1895, pp. 373-375, pll. x, xi.

## 2. *Brontotherium*, sp.

Am. Mus. No. 518.

This skeleton represents the largest size and the last stage in the evolution of the Titanotheres, and was discovered by the American Museum Expedition of 1892 in the Upper Titanotherium Beds of South Dakota, absolutely complete as far back as the border of the pelvis. The hind limbs, belonging to different animals, but of the proper proportions, were secured in the same regions of the West in the summer of 1894.

The complete skeleton, about 7 feet 7 inches (M. 2.31) high; 13 feet 8 inches (M. 4.17) long, and 3 feet 10 inches (M. 1.17) broad, probably belongs to an adult female, as we judge from the imperfect development and ossification of the horns, which in males of this period are very long and powerful. An interesting feature of the skeleton is an exostosis and false joint in the centre of the seventh rib, undoubtedly an after-result of fracture.

OSBORN & WORTMAN, *loc. cit.*, pp. 346-352, pll. viii, ix.

## 3. *Hyrachyus agrarius* Leidy.

 Am. Mus. No. 5065.

This is the original skeleton discovered by Professor Cope himself in his explorations in the Bridger Basin (Middle

Eocene) in 1873, and was mistakenly referred by him to *H. eximius*. It was mounted as found, with an incomplete skull, and so figured by Cope in 'The Tertiary Vertebrata.' The American Museum Expedition of 1893 secured a complete skull belonging to this species, and of the proper size, which has been affixed to the skeleton. In order fully to expose the bones, and correct several errors in the original mounting, the entire animal was taken apart and remounted, as here photographed. The animal was about as large as a sheep, and is the oldest known type of Rhinoceros, more directly ancestral to the Hyracodon or Cursorial Rhinoceros of the Oligocene.

COPE, Tertiary Vertebrata, U. S. Geol. and Geog. Sur. Terr's, F. V. Hayden in charge, Final Report, Vol. IV (1885), pp. 657-677, pll. liv, lv, lva, etc.

OSBORN & WORTMAN, Perissodactyls of the White River Beds, Bull. Am. Mus. Nat. Hist., VII, 1895, pp. 367-371.

#### 4. *Patriofelis ferox* (Marsh).

Am. Mus. No. 1507.

This animal was originally described by Leidy from a fragment of the lower jaw. The American Museum Expedition of 1893 procured the complete skeleton, represented in two different animals, in which the skull alone was in an imperfect fragmentary condition, and the teeth, unfortunately, entirely wanting. This animal was as large as a jaguar, and exhibits short, powerful, highly flexed limbs, widely spreading clawed feet, heavy backbone, very deep sagittal crest and small brain case. It is a typical Middle Eocene Creodont, with highly specialized cutting teeth.

WORTMAN, The Osteology of *Patriofelis*, Bull. Am. Mus. Nat. Hist., VI, 1894, pp. 129-164, pl. i.

OSBORN, *Oxyæna* and *Patriofelis* Re-studied as Terrestrial Creodonts, Bull. Am. Mus. Nat. Hist., XIII, 1900, pp. 269-279, pll. xviii, xix.

#### 5. *Protorohippus venticolus* (Cope).

Am. Mus. No. 4832.

This is the famous skeleton described by Cope in 'The Tertiary Vertebrata,' as the four-toed Lower Eocene Horse.

It was found by Dr. J. L. Wortman in the Wind River Beds of Wyoming (Middle Eocene). Since its purchase by the American Museum the entire skeleton has been taken apart and remounted as a walking animal; in the original mounting the animal was represented as pacing. The skeleton is far from perfect, the limbs upon the left side being largely restored, while those upon the right side are complete. The ribs are entirely restored, as is the pelvis. In the remounting of the skeleton these missing parts were studied from the corresponding bones in the well-known form *Mesohippus*.

COPE, Tertiary Vertebrata, pp. 635-647, pl. xlix *a*, *b* and *c*.

WORTMAN, Species of *Hyracotherium* and allied Perissodactyls from the Wahsatch and Wind River Beds of North America, Bull. Am. Mus. Nat. Hist., VIII, 1896, pp. 81-110.

#### 6. *Hoplophoneus primævus* Leidy.

Am. Mus. No. 1406.

The skeleton was procured by the American Museum Expedition of 1894 in the Oreodon Beds of South Dakota, and is one of the most complete fossil skeletons ever found. The only parts missing were some of the processes and spines of a few vertebræ. This animal is characterized by powerful canines protected by a heavy flange upon the lower jaw, and is considered the ancestor of the great Sabre-tooth Tiger *Smilodon*.

RIGGS, Restoration of *Hoplophoneus occidentalis* Leidy, Kan. Univ. Quar., V, 1896, pp. 37-52, pl. i.

#### 7. *Palæosyops major* Leidy.

Am. Mus. No. 1544.

*Palæosyops* was one of the first fossils found in the Eocene deposits of the Western States. Materials for this mounted skeleton were secured with great difficulty by the American Museum Expeditions of 1893 and 1895 in the Bridger and Washakie Beds of Wyoming. The skull, fore limbs and foot, and a large part of the vertebral column and ribs belong to a single skeleton, and the parts associated with these were put

together after being positively determined as belonging to this species, and as representing individuals of corresponding age. The skeleton is thus believed to represent accurately the original, and there is little restoration, except in the head of the femur. This species is distinguished by the convexity of the forehead, and by the low, flattened cones of the molar teeth, and is not directly ancestral to the later *Titanotheres*.

EARLE, On the genus *Palæosyops*, etc., Jour. Acad. Nat. Sci. Phila., 1892

### 8. *Phenacodus primævus* Cope.

Am. Mus. No. 4369.

This is the famous skeleton of *Phenacodus* found by Dr. Wortman in the Lower Eocene of the Big Horn Basin, Wyoming, and described by Cope in 'Tertiary Vertebrata' and other publications. It here has an entirely different appearance, and gives us a different conception of the animal from that presented in its original mounting. The skeleton was very largely embedded in the rock, and it required four months of continuous work to remove the limbs, ribs and vertebræ preparatory to remounting. The animal as figured in 'Tertiary Vertebrata' appeared like a plantigrade; it was, however, restored by Sir William Flower in his book upon the Horse as a digitigrade. As here shown, the animal was as digitigrade as the Tapir; the hind limbs are much longer and more powerful than the fore; the tail is of great size. The head, on the other hand, is extremely small, and out of all proportion to the body. It is thus a microcephalic type, in contrast with *Coryphodon*, which is macrocephalic.

COPE, Tertiary Vertebrata, pp. 428-463, pll. lviib-lviii.

OSBORN, Remounted Skeleton of *Phenacodus*, Bull. Am. Mus. Nat. Hist., X, 1898, pp. 159-164.

### 9. *Coryphodon testis* Cope.

Am. Mus. No. 2865.

*Coryphodon* is the characteristic large mammal of the Lower Eocene or Wasatch. Its remains are usually found scattered,

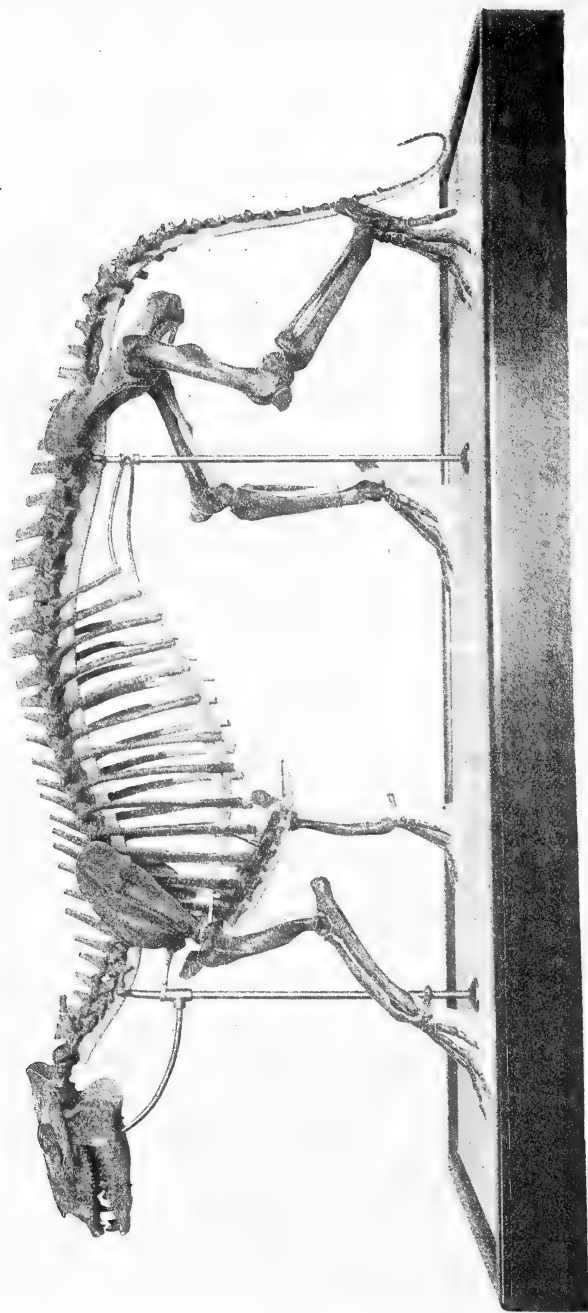


Fig. 7. Mounted skeleton of *Phenacodus primigenus* in the American Museum of Natural History. One-twelfth natural size.

and it was not until 1896 that the Museum Expeditions enabled us to mount the complete skeleton. The animal exhibits a curious mixture of primitive and specialized characters, the former being dominant in the limbs and body, the latter appearing in the skull and feet. The flat-topped skull with slight rudiments of frontal and parietal horns, the spreading, hippopotamus-like front teeth, the short elephantine feet and broad pelvis, are the most noticeable specialized characters. *Coryphodon* was nearly related although not directly ancestral to the Uintatheres (*Dinoceras*) of the Middle Eocene or Bridger Beds.

The skeleton as mounted is composed of a number of individuals of the same species, size and age, collected by the Museum Expedition of 1896.

OSBORN, *Coryphodon radians* Cope, A Complete Skeleton of *Coryphodon*, Bull. Am. Mus. Nat. Hist., X, 1898, p. 81.

*Coryphodon testis* OSBORN, Evolution of the Amblypoda, *ibid.*, pp. 189-204.

See also MARSH, Am. Jour. Sci., 1893, p. 321.

#### 10. *Teleoceras* (*Aphelops*) *fossiger* (Cope).

Am. Mus. No. 2604.

This Rhinoceros was the most abundant large animal of the Upper Miocene of Western America. Its bones are found in some localities (such as the famous quarry at Long Island, Phillips Co., Kansas) in great numbers and remarkably well preserved, but the individuals are not distinguishable. This skeleton, made up of many individuals of appropriate size, is mounted with concealed steel rods traversing the bones and only two visible main supports. The male probably bore a small horn, which was rudimentary or absent in the female. The animal had much shorter legs and a heavier body than any modern Rhinoceros, the principal measurements being: height at shoulder, 4 ft. (M. 1.22); at pelvis, 3 ft. 8 in. (M. 1.12); total length, 10 ft. 3 in. (M. 3.12); greatest girth or chest circumference, 9 ft. 2 in. Its size was about that of the largest living species, except in the height. The neck was

short, the head rather small, the body extremely thick and barrel-like, the belly almost reaching the ground.

OSBORN, Bull. Mus. Comp. Zoöl., XX, p. 92; Bull. Am. Mus. Nat. Hist., X, 1898, p. 51.

WILLISTON, Restoration of *Aphelops fossiger*, Kans. Univ. Quar., 1894, p. 289, pl. viii.

## 11. *Cænopus tridactylus* (Osborn).

Am. Mus. No. 538.

This skeleton was found by the American Museum Field Party in 1892, and was the first skeleton mounted by the Department; although very complete it is considerably crushed, and has been mounted in low relief. The skeleton as it lay in the rock was doubled over on itself; it has been straightened out and a missing fore limb modelled in plaster, otherwise it is in the position that it had in the rock. The matrix is chiefly plaster, colored and chipped to imitate the surface of the gray sandstone original. Length from tip of nasals to bend of tail, 7 feet 9 inches. The animal was about the size of the living Sumatran Rhinoceros, but was hornless, or with rudimentary *paired* horns on the male.

OSBORN & WORTMAN, Fossil Mammals of the Lower Miocene White River Beds, Bull. Am. Mus. Nat. Hist., VI, 1894, pp. 206-207, pl. iii.

OSBORN, Mem. Am. Mus. Nat. Hist., Vol. I, Pt. IV, Oct., 1899.

## 12. *Phenacodus wortmani* Cope.

Am. Mus. No. 4378.

This small species of *Phenacodus* was found by Dr. Wortman in the same beds as *P. primævus*. This skeleton was mounted in the original matrix in the Cope Collection, but has been chiselled out of the rock and remounted in low relief, the missing parts of the bones being restored in plaster. Each bone is easily removable for separate study.

COPE, Tertiary Vertebrata, p. 464, pl. xxixe.



**13. *Cænopus occidentalis* (Leidy).**

Am. Mus. No. 1132.

This characteristic Rhinoceros of the Middle Oligocene of the West is ancestral to *C. tridactylus* of the Upper Oligocene, and thus leads to the Diceratheres line. *C. occidentalis* was hornless, somewhat smaller than the living Sumatran Rhinoceros and more lightly proportioned. This skeleton is mounted in full relief.

OSBORN, Mem. Am. Mus. Nat. Hist., I, Pt. III, April, 1898.

**14. *Tylosaurus dyspelor* (Cope).**

Am. Mus. No. 221.

Upper Cretaceous (Niobrara) of Kansas.

*Tylosaurus dyspelor* was one of the largest of the Mosasaurs, great marine lizards, distantly related to the living Monitor Lizard (*Varanus*), but adapted to strictly aquatic life. This fine skeleton, found by Mr. W. G. Bourne, is twenty-eight feet long and exceptionally perfect, even the cartilages being preserved. The skeleton is mounted in the original matrix and position.

OSBORN, Mem. Am. Mus. Nat. Hist., I, Pt. IV, October, 1899.

**15. *Protoceras celer* Marsh.**

Am. Mus. No. 1236.

Upper Oligocene (White River, Protoceras Beds), S. Dakota.

*Protoceras* was the largest of a group of Primitive Ruminants found in the White River Beds, which had two toes in the hind foot, four in the fore foot. The proportions are nearly those of the smaller deer, but with shorter limbs and neck. The male skull bore several bony bosses comparable to the bosses on a giraffe skull instead of true horns or antlers; the

female was hornless. This skeleton is that of a female, and is mounted in high relief.

MARSH, Am. Journ. Sci., 1891, Jan., p. 81; 1893, Nov., p. 407; 1897, Sept., p. 165.

OSBORN & WORTMAN, Characters of *Protoceras*, Bull. Am. Mus. Nat. Hist., IV, 1892, p. 351.

SCOTT, Osteology and Relations of *Protoceras*, Jour. Morph., XI, p. 303.

## 16. *Oxyæna lupina* Cope.

Am. Mus No. 107.

Lower Eocene (Wasatch), Big Horn Valley, Wyoming.

*Oxyæna* was a typical Creodont or Primitive Carnivore. Large head, with small brain and long, powerful jaws, short, bandy legs, short, subplantigrade feet, and long tail, are the most marked primitive characters.

This skeleton was pieced together with great labor out of two fragmentary specimens, one found by Dr. Wortman in 1881 and described by Cope in 'Tertiary Vertebrata' (Specimen No. 2), the other found in 1891 and described by Osborn and Wortman in the American Museum Bulletin for 1892. On comparing these two specimens it was found that they belonged to the same individual, and that the skeleton was nearly complete, though broken into innumerable fragments. The skeleton is mounted in full relief, every bone being removable.

WORTMAN, Restoration of *Oxyæna lupina* Cope, etc., Bull. Am. Mus. Nat. Hist., XII, 1899, p. 139.

## 17. *Equus scotti* Gidley.

### 17a. *Equus scotti* and *Protorohippus venticolus*.

Am. Mus. No. 10612.

Pleistocene, Rock Creek, Llano Estacado, Texas.

This skeleton is one of eight found together by J. W. Gidley of the American Museum Expedition of 1899. It shows as

mounted the zebra-like proportions of this native American wild horse, especially seen in the large head and deep jaws, short barrel, small limbs and feet.

GIDLEY, A new Species of Pleistocene Horse from the Staked Plains of Texas, Bull. Am. Mus. Nat. Hist., XIII, 1900, pp. 111-116; and Revision of American Species of *Equus*, *ibid.*, 1901, XIV, pp. 91-140.

**18. *Amynodon intermedius* S. & O.**

Am. Mus. No. 1931.

Upper Eocene (Uinta) Utah. Found by A. O. Peterson, American Museum Expedition, 1895.

*Amynodon* was a collateral ancestor of the large Aquatic Rhinoceros, *Metamynodon*, of the Oligocene epoch, and is largely intermediate, both in size and in characters of the skull and skeleton, between it and the Middle Eocene Rhinoceros. This skeleton is mounted in high relief.

**19. *Mastodon americanus* (Kerr).**

Pleistocene Epoch, Newburgh, New York.

Remains of *Mastodon* have been found in numerous localities scattered all over the Eastern States and Mississippi Valley, and mounted skeletons are to be seen in several American and European museums. This skeleton was found in a peat bog near Newburgh, N. Y., and is one of the largest; size, 9 feet high, 18 feet long as mounted. The Mastodons differed strikingly from the Mammoths in proportions, as well as in the number and character of their teeth, form of skull and curve of tusks.

**20. *Platygonus leptorhinus* Williston.**

Pleistocene Epoch, Kansas.

This skeleton is one of nine found together in Western Kansas and described by Prof. Williston in 1894. The proportions and pose of the skeleton at once suggest the living peccaries (*Dicotyles*), from which *Platygonus* differed chiefly in its larger size, more specialized feet and teeth.

**21. *Oreodon culbertsoni* Leidy.**

Oligocene Epoch, Big Badlands, S. Dakota.

*Oreodon* was first described by Joseph Leidy in 1851, and is the most abundant and characteristic fossil of the Big Badlands. This species is of the size of a peccary, and the skeleton, a composite of two very perfectly preserved individuals obtained by the American Museum Expedition of 1894, shows somewhat similar proportions, but is much more primitive in characters, and in most respects has departed comparatively little from the old ancestral type of the Artiodactyla.

**22. *Hyænodon horridus* Leidy.**

Am. Mus. No. 1375.

Oligocene Epoch, Big Badlands, South Dakota.

This finely preserved skeleton was found by the American Museum Expedition of 1894, and is all one individual, the few missing parts being restored in tinted plaster. *Hyænodon* is the best-known and the most highly developed of the Creodonta, and is found both in Europe and America. This species is about the size of the Tasmanian Wolf (*Thylacinus*), which it resembles to a striking degree in proportions of limbs and feet and in many characters of the skull.

**23. *Pantolambda bathmodon* Cope.**

Basal Eocene, San Juan Basin, New Mexico.

*Pantolambda* is the most ancient mammal of which the entire skeleton is known. This mount is a composite of several incomplete skeletons obtained by the American Museum Expedition of 1896 in the Torrejon (Upper Puerco) horizon of Northwestern New Mexico. It exhibits the short, crooked legs, five-toed, plantigrade feet, long, heavy tail, arched back, primitive skull, with heavy jaws and small brain case, and many other characters which were the common heritage of the early mammals from their reptilian ancestors. OSBORN, Evolution of the Amblypoda, Bull. Am. Mus. Nat. Hist., X, 1898, pp. 183-188.

**24. *Hypohippus equinus* (Scott).**

Middle Miocene, Pawnee Buttes, Colorado.

This three-toed Horse is not in the direct line of descent of the modern horses, but on a somewhat conservative side-branch. The skeleton is as large as that of a Shetland pony and is mounted in full relief in a walking pose. The head, limbs, and feet are in exceptionally fine preservation. The side view shows best the general proportions of the animal; the view from behind, which best displays the small lateral digits, can also be supplied. *Hypohippus* is closely related to *Anchitherium* of the Lower Miocene, from which it is probably directly descended. This skeleton was found by Mr. Brown of the American Museum Expedition of 1901.

**25. *Ichthyosaurus quadriscissus* Quenstedt.**

Jurassic Period, Holzmaden, Wurttemberg.

This fine skeleton was presented to the American Museum by the Royal Natural History Museum of Stuttgart, through Prof. Eberhardt Fraas. It is of especial interest as showing that the Ichthyosaurs were viviparous instead of egg-laying reptiles. The skeletons of seven young (unborn) Ichthyosaurs can be seen, partly in, partly washed out of the body-cavity.

**26. *Portheus molossus* Cope.**

Upper Cretaceous (Niobrara) of Kansas. Found by C. H. Sternberg.

This great fish is characteristic of the marine Upper Cretaceous chalk formation of Western Kansas. It was related to the modern Tarpon of Florida but of gigantic size, this skeleton being 18 feet in length. The head and tail are especially fine; the ribs and fins are mostly restored in plaster. It is much flattened and is mounted in low relief.

**27. *Hippopotamus liberiensis* Morton.**

The Pigmy Hippopotamus of the West Coast of Africa is a rare species, almost extinct. This skeleton is semi-fossil, and was presented by the Museum of Christiania, Norway.

**28. *Ornitholestes hermanni* Osborn.**

Upper Jurassic (Como), Wyoming.

This beautiful little skeleton, about seven feet in length, represents a little-known group of Carnivorous Dinosaurs adapted for swift running and the seizing of a light and agile prey. The tail is extremely long, slender, and whip-like, the hind limbs long and the feet like those of a bird, while the small fore limbs are modified into remarkable prehensile organs, the first and second digits greatly elongated and opposed, with large curved claws, the third digit small and slender, and the fourth atrophied.

OSBORN, Bull. Am. Mus. Nat. Hist., XIX, 1903, pp. 459-464.

**29. *Mesohippus bairdi* Leidy.**

Middle Oligocene (White River), South Dakota.

This classic species represents an early stage in the evolution of the Horse. It is smaller than the modern Dorcas Gazelle, and has three toes on each foot, the lateral toes slender but reaching to the ground. Vestiges of the first and fifth digits are still preserved in the fore foot. *Mesohippus* is somewhat peculiar in the unusual length of the hind limbs as compared with the fore; in other respects it is intermediate between the four-toed horses of the Eocene and the modern horse.

SCOTT, W. B., On the Osteology of *Mesohippus* and *Leptomeryx*, Jour. Morph., V, 1891, pp. 301-406.

FARR, Notes on the Osteology of the White River Horses, Proc. Amer. Phil. Soc., XXXV, 1896, p. 147-175.

**30. *Merycodus osborni* Matthew.**

Middle Miocene, Pawnee Creek Bed, Colorado.

*Merycodus* is a collateral ancestor of the modern Pronghorn Antelope of Western North America, but is distinguished by large, branching, deciduous antlers like those of the Deer.

The bony rudiments of lateral toes, present in nearly all deer but absent in all antelopes, are still preserved in *Merycodus*, but exceedingly minute, much smaller than in the deer. The animal was of about the size of the Dorcas Gazelle.

MATTHEW, W. D., A Complete Mounted Skeleton of *Merycodus*, Bull. Am. Mus. Nat. Hist., XX, 1904, pp. —.

See also SCOTT, W. B., Bull. Mus. Comp. Zool., XX, 1890, p. 82 (*Cosoryx furcatus*).

#### IV.—PHOTOGRAPHS OF RESTORATIONS, BY CHARLES KNIGHT.

*Presented by J. Pierpont Morgan, and exhibited in the Department of Vertebrate Paleontology. Bromide enlargements from the original negatives. Size, 18 in. x 22 in.*

These photographs are from a series of large water colors executed for the American Museum by the animal painter, Mr. Charles Knight, under direction of Prof. Osborn, with suggestions and criticisms by other palæontologists, the object being to increase the popular interest in these extinct animals, and to give a fuller and truer idea of their anatomy and external form than is afforded by the skeleton.

The artist begins each study by preparing a number of models in wax, based upon the actual proportions and muscular indications of the skeleton, and by a series of preliminary sketches, representing different attitudes, habits, and surroundings. Thus the position of all the joints and angles of the feet and limbs is true to life. The lips, nostrils, and gape of the mouth are determined by comparison of the length of the nasals, size of the anterior nares, character and position of the teeth, with similar parts in the remotely related living forms. The eyes are carefully located and proportioned. Up to this point the animal is a fairly correct representation of the original. On the other hand, the shape of the ears, the color and epidermic characters of hair and hide are largely imaginative, except in so far as they are suggested by relationship

to modern allies, as of *Protorohippus* to the Horse, or of *Cænopus*, *Metamynodon*, and *Hyracodon* to the Rhinoceros.

*These restorations are copyrighted and the photographs are sold with the understanding that they are to be used only for exhibition purposes, and are not to be copied or adapted for publication.*

*Price of the photographs, \$4 each.*

## 1. *Patriofelis*, Middle Eocene Creodont.

This animal is based upon studies of the skeleton mounted in the American Museum Collection (No. 1507). The following quotation from an article by Dr. Wortman explains the picture: "The broad, flat, plantigrade feet, with their spreading toes, suggest at the first glance their use for swimming. The eversion of the feet, together with the general clumsiness of the limbs point, moreover, to the fact that the animal was not an active runner. . . . He was perhaps not as expert a swimmer as the seals are now, but was sufficiently active in the water to capture turtles." This is perhaps the least original and successful of the restorations, being modelled somewhat too closely upon the Otter. More recent studies by Osborn have cast much doubt upon the aquatic habits of the animal as indicated by Wortman.

Originally reproduced by Osborn in 'Prehistoric Quadrupeds of the Rockies,' Century Magazine, September, 1896.

WORTMAN, The Osteology of *Patriofelis*, Bull. Am. Mus. Nat. Hist., VI, 1894, pp. 119-64, pl. i.

OSBORN, *Oxyæna* and *Patriofelis* Re-studied as Terrestrial Creodonts, Bull. Am. Mus. Nat. Hist., XIII, 1900, pp. 269-279.

## 2. *Protorohippus venticolus*, Four-toed Lower Eocene Horse.

The studies for this animal were based upon skeleton No. 4832, mounted in the American Museum Collection. The very primitive characters of this early stage in the evolution of the Horse are especially seen in the short neck and legs, the heavily muscular part of the limb extending much further down in proportion to the lower leg and foot. The arched



back and short head are likewise striking characters. The striping of the neck and fore quarters is based upon the fact that the young of all modern species of *Equidæ* show a more

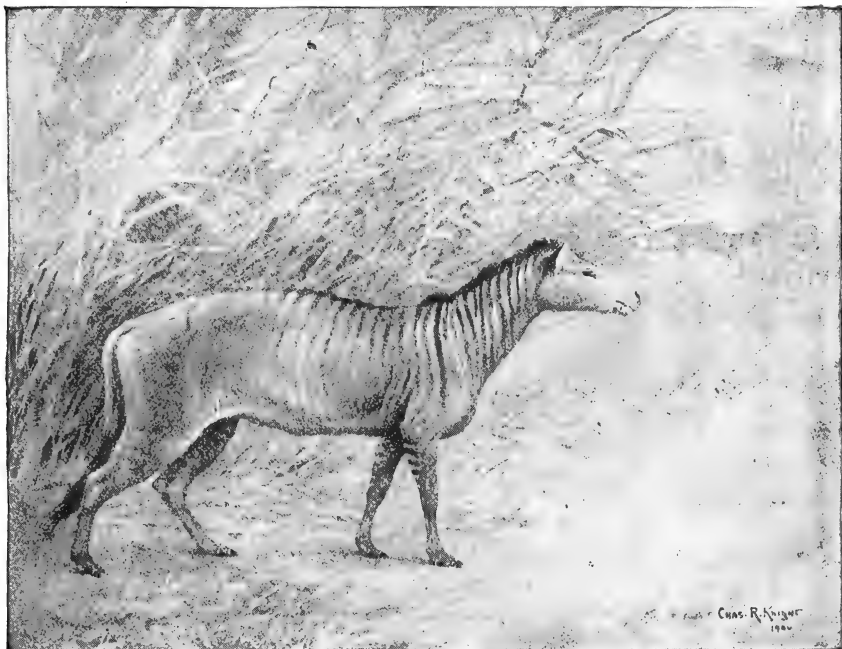


Fig. 8. Restoration of the Four-toed Eocene Horse *Protorohippus*. Height at withers sixteen inches.

or less marked tendency to striping in these parts. The animal in life was about 4 hands, or 16 inches, in height at the withers.

Originally reproduced by Lucas in McClure's Magazine. 1899.

COPE, Tertiary Vertebrata, U. S. Geol. & Geog. Sur. Terrs., F. V. Hayden in charge, Final Report, IV (1885), pp. 635-647, pll. xlix, a, b, c.

### 3. *Cænopus*, A Hornless Upper Oligocene Rhinoceros.

The study is based upon the complete mounted skeleton, No. 538, in the American Museum, of *Cænopus tridactylus*. This animal compares in its dimensions and in the general characters of its skeleton with the Two-horned Rhinoceros of

Sumatra; and Mr. Knight's studies for this picture were practically based upon that living type.

OSBORN & WORTMAN, Fossil Mammals of the Lower Miocene White River Beds, Bull. Am. Mus. Nat. Hist., VI, 1894, p. 206, pl. iii.

#### 4. *Protoceras*, Six-horned Upper Oligocene Ruminant.

The characters of this animal are known from complete female skeletons in the American Museum of Natural History and the Princeton Museum, and a very complete series of male and female skulls, secured by the American Museum Expeditions of 1892 and 1894. As exhibited, there is a wide contrast between the male and female skulls, the latter being entirely devoid of horns. The very marked recession of the nasals has suggested the presence of a long, somewhat expanded upper lip, as in the modern Saiga, while the coloring of the animal is based upon that of the North American Pronghorn Antelope.

Originally reproduced by Osborn in the Century Magazine, September, 1896.

OSBORN & WORTMAN, Characters of *Protoceras* Marsh, Bull. Am. Mus. Nat. Hist., IV, 1892, pp. 351-371.

#### 5. *Metamynodon*, Aquatic Middle Oligocene Rhinoceros.

The study is based upon the mounted skeleton, No. 546, in the American Museum, and represents the general conception of the animal as aquatic. The opinion as to the aquatic habits of *Metamynodon* was very largely due to the studies made for this drawing in which it became apparent that the very elevated position of the orbits, the widely expanding ribs, and the four complete spreading toes in the fore foot, strongly suggested the general build of the Hippopotamus. This aquatic life is, moreover, consistent with the presence in the same beds of two other types of Rhinoceros, it being improbable that the three types were all land animals.

Originally reproduced by Osborn in the Century Magazine, September, 1896.

OSBORN & WORTMAN, Perissodactyls of the Lower Miocene White River Beds, Bull. Am. Mus. Nat. Hist., VII, 1895, pp. 373-375 pl. x, xi.

## 6. Elotherium, Giant Upper Oligocene Suilline.

These animals have been depicted from very complete remains in the American and Princeton Museums, and represent the largest type of Oligocene Elothere, namely, the *E. ramosum* of Cope, or *E. imperator* of Marsh. The great flanges below the cheeks for the attachment of the masseter muscles presented peculiar difficulties, and it is possible that they are not here exhibited with sufficient expansion. The head is of enormous size, but the chest is small, and the limbs are comparatively tall and stilted, as here represented. The very remote relationship to the Pig and to the Hippopotamus is suggested in the bristles and in the form of the lips. *Elotherium* is in a general way a sort of dry-land hippopotamus, as *Metomynodon* is an aquatic rhinoceros; in the one case the dry-land type, in the other, the aquatic type, has become extinct.

Originally reproduced by Osborn in the Century Magazine, September, 1896.

MARSH, Am. Jour. Sci., XLVII, 1894, p. 408, pl. ix.

## 7. Megacerops, Long-horned Lower Oligocene Titanotheres.

This group of male, female, and young is based upon skulls belonging to different sexes and ages, in the American Museum Collection, as well as upon the complete skeleton, No. 518, mounted in the American Museum. There is no doubt that the females had smaller skulls, with imperfectly developed horns and narrow zygomatic arches, while the males of the same species had extremely long, recurved horns. The extension of the premaxilla and the overhanging of the nares by the rudimentary nasals indicate that there was not space for a proboscis, but rather a prehensile upper lip, which suggests the same structure in the Rhinoceroses.

Originally reproduced by Osborn in the Century Magazine, September, 1896.

OSBORN & WORTMAN, Perissodactyls of the Lower Miocene White River Beds, Bull. Am. Mus. Nat. Hist., VII, 1895, pp. 346-352, pll. viii, ix.

### 8. *Uintatherium*, Six-horned Middle Eocene Amblypod.

The male and female here represented are based upon skeletal material as yet unmounted in the American Museum Collection, also upon the reconstruction published by Professor O. C. Marsh. The structure of the male skull, as here represented, corresponds with the largest type ever found, that of the *Uintatherium cornutum* skull, discovered by Professor Cope himself, and now in the American Museum. There is no indication of a proboscis, nor is there any reason to believe that the bony protuberances bore horns, many of them expanding at the tip, as is never the case with true horn-cores. The tusks, both in male and female, are found chiefly worn upon the posterior surface, a fact which suggests that they were used upon branches in drawing leaves and shrubs into the mouth, as represented in the female figure in the rear. Their chief function was probably as weapons of defence or attack, the exceptionally wide gape of the jaw, as indicated by the position and form of its muscular attachments, giving room for their use in a very effective manner.

Originally reproduced by Osborn in the Century Magazine, September, 1896.

COPE, Tertiary Vertebrata, pp. 569-587, pll. xxxvii-xlii.

MARSH, The Dinocerata, U. S. Geol. Sur. Mon., X, pp. 1-243, pll. i-lvi, 1886.

### 9. *Hyracodon*, Cursorial Oligocene Rhinoceros.

This restoration is based also upon material in the American Museum and Princeton Collections. The general conception of *Hyracodon* as a running type was outlined by Scott in 1883. These animals thus presented the widest contrast to the swimming Rhinoceroses, or *Metamynodon*, on the one side, and the low-land or swamp Rhinoceroses, the *Aceratheres*, on the other. The upper molar teeth, however, closely resemble those of the Rhinoceros, and form the motive for the resemblance to this animal, which is given in the face. The trunk and limbs, on the other hand, resemble very closely

those of the primitive horses. Hence the motion characteristic of the galloping horse is given to the skeleton.

Originally reproduced by Osborn in the Century Magazine, September, 1896.

SCOTT, Osteologie von Hyracodon Leidy, Festsch. f. Gegenbaur, 1896, pp. 353-383, pll. i-iii.

#### 10. Mesonyx, Omnivorous Middle Eocene Credont.

This huge animal is represented preying upon the skull of an Uintathere, in order to give some conception of its size. The skull, as represented in the American Museum Collection, No. 1892, is extremely large and armed with very blunt teeth, wearing down in old age, indicating that the animal was omnivorous, or lived partly upon turtles or decaying animal food. The form of this body is derived from a complete skeleton in the Princeton Museum, which has been figured by Scott. It slopes backwards, the posterior quarters being rather small; the tail is extremely long and powerful, the general proportions resembling somewhat those of the Tasmanian Wolf.

Originally reproduced by Osborn in the Century Magazine, September, 1896.

SCOTT, New and Little-known Creodonts, Jour. Acad. Nat. Sci. Phila., IX, 1887, pp. 155-185, pll. v-vii.

WORTMAN, Studies of Eocene Mammalia in the Marsh Collection, Part I, Carnivora, Am. Journ. Sci., XII, 1901, pp. 285, 377, 421; XIII, 1902, p. 39.

#### 11. Palæosyops, Eocene Hornless Ancestral Titanotheres.

This animal is based upon the complete skeleton mounted in the American Museum, and is represented as having somewhat the habits of the Tapir, living in low, marshy land, and feeding entirely upon the softer kinds of leaves and grasses, since its teeth are entirely unadapted to hard grasses or the more silicious plants. According to the studies of Earle, the animal was devoid of a proboscis, but had an elongated, prehensile upper lip. The slender fore feet are very similar in proportions to those of the aquatic Rhinoceroses.

Originally loaned for reproduction in Harper's Magazine, 1897.

EARLE, On the genus *Palæosyops*, etc., Jour. Acad. Nat. Sci. Phila., IX., 1892, pp. 267-388, pll. x-xiv, and restoration, p. 314.

**12. Mastodon americanus, North American Pleistocene Elephant.**

This animal is executed from the skeleton in the American Museum of Natural History, and it is characterized by being partly hairy, in contrast with the extremely hairy northern variety of the Mammoth, and in view of the probability that all the more primitive elephants were coated with hair. It has distinctly the low, flat skull of the African Elephant, whereas the Mammoth had the high, prominent forehead characteristic of the Indian Elephant. The skeleton is also distinguished by enormously large, projecting feet, larger than in any existing species, and by the relative shortness of the limbs, also a primitive feature. This restoration, therefore, while based upon studies of the elephant, exhibits the characteristic proportions which distinguished the *Mastodon* externally.

Originally executed for reproduction in Harper's Magazine, 1897.

**13. Dryptosaurus (Laelaps), Carnivorous Cretaceous Dinosaur.**

In this and the four following restorations Mr. Knight was guided largely by ideas and sketches given him by Prof. Cope shortly before the latter's death. They are based upon specimens in the Cope Collection now in the American Museum, and upon restorations by Professor Marsh of related types.

This Dinosaur, represented in the photograph as engaged in combat, was of considerable size, about fifteen to twenty feet in length, and well armed in teeth and claws. Prof. Cope considered that the long hind limbs and heavy tail indicated great leaping powers, in spite of its large size, and the restoration is made in accordance with this idea. *Dryptosaurus* was allied to *Ceratosaurus* of Marsh and to the European *Megalosaurus*. COPE, Proc. Acad. Nat. Sci. Phila., 1866, 275; Proc. Am. Phil. Soc., XXX, p. 240, May, 1892.

MARSH, Dinosaurs of North America, pp. 157-163, pl. xiv.

**14. Elasmosaurus, Long-necked Cretaceous Plesiosaur.**

*Elasmosaurus* was one of the largest of the marine reptiles which inhabited the Cretaceous seas. It was related to the

European *Plesiosaurus*, which it resembled in shape, except in the flattened tail. It is represented in the restoration as capturing a young *Porthenus*, one of the large, bony fishes of the period. A skeleton in the Museum of the Philadelphia Academy of Natural Sciences, and another more complete in the Cope Collection (but both lacking the skull), served as the basis for the restoration. The Plesiosaurs differed greatly in the length and flexibility of the neck, as well as in size.

COPE, Cretaceous Vertebrata, U. S. Geol. & Geog. Surv. Terrs., F. V. Hayden in charge, Final Report, II, pp. 75-88.  
DAMES, Abh. k. preuss. Akad. Wiss. Berlin, 1895, pp. 75-80; Natural Science, Jan., 1898, p. 48.

### 15. *Agathaumas*, Three-horned Cretaceous Dinosaur.

These herbivorous Dinosaurs were of great size and had large heads armed with three horns, and a great projecting crest or frill protecting the neck. The body may have been covered with small bony plates (scutes). This restoration is based on a reconstruction of the skeleton of *Triceratops prorsus* by Prof. Marsh. *Agathaumas sphenocerus* Cope, shown in the picture, is distinguished by the large anterior median horn and small posterior paired horns.

COPE, Amer. Nat., 1886, p. 716; 1892, p. 768.  
MARSH, Dinosaurs of North America, Ann. Rep. U. S. Geol. Surv., 1896.

### 16. *Naosaurus* and *Dimetrodon*, Spine-backed Permian Lizards.

These ancient reptiles represent an early specialized branch of the primitive Rhynchocephalians. Their most remarkable character is in the enormously elongated dorsal spines of the vertebræ, with (in *Naosaurus*) or without (in *Dimetrodon*) transverse bars of bone. The restoration is based on a number of incomplete skeletons in the Cope Collection.

COPE, Proc. Amer. Phil. Soc., 1878, p. 512.  
BAUR & CASE, Morphology of the Skull of the Pelycosauria, Anatom. Anzeig., Jena, 1897, XIII, p. 109.

### 17. *Hadrosaurus*, Duck-billed Cretaceous Dinosaur.

Drawn from the unusually complete skeleton of *Hadrosaurus* (*Diclonius*) *mirabilis* Leidy, in the Cope Collection now in the American Museum. This very specialized genus is found in the Upper Cretaceous of New Jersey and Wyoming. It was herbivorous, and probably amphibious, with long neck and heavy hind quarters. It had a broad, duck-like, horny bill, and back of it a magazine of numerous small, rod-like teeth, not less than a thousand in each jaw, set on end in several close-set rows, and wearing to a tessellated-pavement-like grinding surface. The length was about thirty feet.

The skeleton of a nearly related genus, *Claosaurus*, is mounted in the Yale Museum.

COPE, Proc. Acad. Nat. Sci. Phila., 1883, p. 97; Amer. Nat., 1883, p. 774.

### 18. Siberian Mammoth or Hairy Elephant.

Unlike the living elephants, the Mammoth ranged into arctic countries, and is here restored with its appropriate environment, taken from the region of the Taku Glacier, Alaska. It was a contemporary of primitive man, and its enormous size is therefore fitly indicated by the contrast with human figures in the background. In this instance the color and texture of the hide is certainly known, from the mammoth carcasses which have been found frozen in the palæocrystic ice of northern Siberia, and parts of which are still preserved in the St. Petersburg Museum.

### 19. *Cervalces*, Pleistocene American Elk.

*Cervalces* was as large as the Moose, but is distinguished by its magnificent antlers, spreading in three directions, outward, upward, and forward, and attaining a size and complexity unequalled by any living species. The fine skeleton in the Princeton Museum served as a basis for this restoration, the superficial characters being studied from the Moose.

SCOTT, Proc. Acad. Nat. Sci. Phila., 1885, p. 191.



**20. Condylarth or Primitive Hoofed Mammal Phenacodus.**

Lower Eocene Epoch.

This is drawn after the famous skeleton discovered by Wortman and described originally by Cope, and as remounted by Osborn.

*Phenacodus* belongs to the group of Primitive Ungulates from which all the modern hoofed animals are descended. It is in many respects like the clawed animals (Unguiculates) from which the hoofed animals (Ungulates) branched off. Five toes on each foot, pig-like teeth, arched back, short legs, narrow chest, lank sides, long tail, all are characters of the primitive clawed animals still retained by *Phenacodus*, but lost by modern hoofed animals.

OSBORN, Remounted Skeleton of *Phenacodus primævus*, Bull. Am. Mus. Nat. Hist., X, 1898, p. 159.

COPE, Tertiary Vertebrata, pp. 428-463, pl. lvii b-lviii.

**21. Hornless Amblypod Coryphodon.**

A short-footed, hoofed animal of the Lower Eocene Period.

This remarkable animal was related to the huge Uintatheres. It had five very short toes on each foot. The anterior teeth suggest those of the Hippopotamus, but the grinding teeth are entirely different. The neck is short, the body rather long, with many archaic characters. The legs are short and clumsy, the upper joint disproportionately long. The brain is remarkably small. At the sides of the top of the skull are bony projections prophetic of the posterior horns of the Uintathere.

*Coryphodon* was probably an amphibious animal living in the marshes and rivers bordering the ancient Wasatch Lake. Its large tusks were used presumably in rooting up water-plants, and were also formidable weapons of defense against the larger flesh-eating animals of that period. Its general appearance was unlike that of any modern animal, for, although it combined some characters of such dissimilar beasts as the Bear, Elephant, and Hippopotamus, it had many peculiarities of its own.

OSBORN, Bull. Am. Mus. Nat. Hist., X, 1898, pp. 81-91.

**22. Primitive Sabre-tooth Tiger *Hoplophoneus*.**

Oligocene Epoch.

The most striking difference between Sabre-tooth Tigers and the great living cats is in the long, flattened sabre-like upper canine teeth, which in *Smilodon* (Restoration No. 31) were seven inches long. These teeth could pierce the hides of rhinoceroses and other thick-skinned animals common in America in the Oligocene Period, against which the shorter fangs of modern lions would be ineffective. The legs were shorter and more muscular than those of the larger modern cats, the animal more powerful, but by no means as swift-footed.

SCOTT & OSBORN, Bull. Harv. Mus. Comp. Zoöl., 1887, p. 153, pl. i.

RIGGS, Restoration of *Hoplophoneus occidentalis*, Kans. Univ. Quar., V, 1896, pp. 37-52, pl. i.

**23. Short-legged American Rhinoceros *Teleoceras*.**

Upper Miocene Epoch.

*Teleoceras*, the last known survivor of the Rhinoceros race in America, was also the largest; and its fossil remains are so abundant in certain localities as to indicate that it lived in great herds upon the plains, like the Bison in more modern times.

The body was as long and heavy as that of the living Indian Rhinoceros, but the legs were so short that the belly nearly reached the ground, giving the animal the squat proportions of the Hippopotamus. The male had a small horn on the end of the nose; the female was hornless.

OSBORN, Complete Skeleton of *Teleoceras fossiger*, Bull. Am. Mus. Nat. Hist., X, 1898, pp. 51-59, pll. iv, iva.

WILLISTON, Restoration of *Aphelops fossiger*, Kans. Univ. Quar., 1894, p. 289, pl. viii.

SCOTT & OSBORN, Bull. Harv. Mus. Comp. Zoöl., pp. 92-99, pl. ii.

**24. Amphibious Dinosaur *Brontosaurus*.**

Upper Jurassic Period.

In the Reptilian Age, preceding the Age of Mammals, great reptiles were dominant on land and water. The Dinosaurs, or

Giant Reptiles, were the chief inhabitants of the lowlands and marshes. Preëminent in size among these were the Sauropoda, or Amphibious Dinosaurs, a herbivorous group, mostly of gigantic size, from forty to seventy-five feet in length,—the greatest of land animals living or extinct, and exceeded in size only by the modern Whales.

The long neck and small head enabled them to lie concealed in marshy bayous and lagoons, the body generally immersed, the head foraging for food without easily attracting the attention of the great carnivorous reptiles which lived at this time. The long and massive tail was useful both as a support and a propeller.

*Brontosaurus* was among the largest of the Sauropoda, seventy feet in length and about eighteen feet in height to the arch of the back. The thigh-bone is six feet long, and weighs in its petrified condition 500 to 600 pounds.

MARSH, Dinosaurs of North America, Sixteenth Ann. Rep. U. S. Geol. Surv., 1896, pp. 166-175, pl. xlii (*Brontosaurus excelsus*).  
OSBORN, Bull. Am. Mus. Nat. Hist., X, 1898, p. 219.

## 25. Great Marine Lizard or Mosasaur Tylosaurus.

Upper Cretaceous Period.

This restoration is made from the complete skeleton, thirty feet long, in the American Museum.

The Mosasaurs were carnivorous Sea-Reptiles abundant in the warm, shallow seas of the Upper Cretaceous Period, but not yet found earlier or later. Large flat head, short neck, four paddle-limbs like the flippers of whales, vertically flattened, swimming tail. Length of different species, from twelve to forty feet. Their nearest living ally is the Monitor Lizard (*Varanus*) of the Nile Valley.

OSBORN, A Complete Mosasaur Skeleton, Osseous and Cartilaginous, Memoirs Am. Mus. Nat. Hist., I, Pt. IV, Oct., 1899, pll. xxi-xxiii and text illustrations.  
WILLISTON, Kansas Univ. Quar., VIII, 1899, pp. 39-41; Univ. Geol. Surv. Kansas, IV, Pt. V, pp. 83-221, pll. x-lxxii.

**26. Great Irish Deer *Megaceros*.**

Pleistocene Epoch. Europe.

Drawn from the skeleton mounted in the American Museum. *Megaceros* exceeded any living deer in the spread of its antlers, in some cases ten or even eleven feet from tip to tip. In size it is about equalled by the Moose, but the proportions were somewhat different, approaching those of the Fallow Deer (*Cervus dama*) to which it was more nearly related. The most abundant and complete remains have been found in the bogs of Ireland, but the animal ranged all over Western Europe. It is not found in America.

**27. Primitive Mastodon *Trilophodon*.**

Miocene Epoch.

Based upon a skull and incomplete skeleton in the American Museum, and upon the restored skeleton of *T. angustidens* by Prof. Gaudry. These Miocene ancestors of the Mastodons and Elephants were much less specialized than their later descendants. This is especially seen in the small tusks in both upper and lower jaws, the upper ones curving down, the lower ones straight, and both with an external or anterior enamel band like the incisors of rodents,—in the shorter trunk, as indicated by the characters of the skull, in the limbs of moderate length and toes much less reduced than in the Pliocene and Pleistocene proboscidiens.

**28. Great Carnivorous Dinosaur *Allosaurus*.**

Upper Jurassic Period.

This great carnivorous reptile was a contemporary of the huge Sauropoda. That it preyed on their carcasses is certain, for the bones are often found fossil with scorings and scratches on their softer surfaces which might well have been made by this animal, and its broken-off teeth, still more frequently found close by, suggest that it was more greedy than prudent in its feasts. But the *Allosaurus* was likewise well adapted in

teeth and claws to attack a living prey, and it is quite probable that this was the enemy from whose attacks the huge *Brontosaurus* sought refuge by habitually burying his great unwieldy body beneath the water, as indicated by the skeleton structure and illustrated in our restoration (No. 24) of that beast.

In the *Allosaurus* restoration Mr. Knight has represented him as preying upon the carcass of a Brontosaur, using the powerful bird-like hind feet in somewhat the same manner as does a vulture or other bird of prey.

### 29. Amphibious Dinosaur Diplodocus.

(In preparation.)

### 30. Ichthyosaur, or Great Fish-Lizard.

Jurassic Period.

The discoveries of Ichthyosaurs, with the outlines of body and tail preserved, in the great slate-quarries of Holzmaden in Wurttemberg, as described by Professor Fraas in 1892, have considerably altered our conceptions of this classic fossil reptile. We now know that it had a high, triangular back fin and broad, forked tail, like that of the shark, except that the vertebral column ran into the lower wing instead of the upper wing of the tail. The Holzmaden specimens, worked out with wonderful skill and care by Herr Hauff, give the outlines of almost all parts of the body, so that there is little (except as to color) left to conjecture or inference in this restoration.

Mr. Knight has associated with the old Ichthyosaur a little school of new-born young whose proportions and size are taken from the seven little Ichthyosaur skeletons contained within the body-cavity of the large skeleton in the American Museum.

### 31. Great Sabre-tooth Tiger Smilodon.

Pleistocene Epoch.

Based on the complete skeleton in the Cope Collection, found in the Pampean formation near Buenos Aires, and now mounted in the American Museum.

*Smilodon* may well be considered the most terrible of all

beasts of prey. It equalled in size the largest Polar Bear, and was probably of the most savage and ferocious disposition, fearing nothing, and accustomed to prey on the largest and best-defended of the great herbivora. It did not indeed equal the modern large cats in activity, but it far surpassed any of them in strength, especially in the fore limbs and neck. The extraordinarily powerful attachments for the sterno-mastoid and cleido-mastoid muscles indicate the tremendous force with which the great seven-inch upper canines could be driven into the flesh of the prey, while the extremely wide gape of the jaw, indicated by the form and arrangement of its muscular attachments, gave free play for these powerful weapon-teeth.

The relatively small and low hind quarters and short, small tail give the *Smilodon* an appearance quite unlike the modern great cats, and the characters of skull and neck vertebræ indicate that it carried its head low, and was little able to raise it.

#### IN PREPARATION.

32. *Oxyæna lupina*.
33. *Platygonus leptorhinus*.
34. *Oreodon culbertsoni*.
35. *Poebrotherium wilsoni*.
36. *Hyænodon horridus*.
37. *Cynodictis gregarius*.
38. *Dinictis squalidens*.
39. *Pantolambda bathmodon*.
40. *Hypohippus equinus*.
41. *Elephas imperator*.
42. *Ornitholestes hermanni*.

**BULLETIN**  
**OF THE**  
**American Museum of Natural**  
**History.**

Vol. XX, 1904.

191112  
NEW YORK :  
Published by Order of the Trustees.

1904.

**The Knickerbocker Press, New York**



(Continued from 4th page of cover.)

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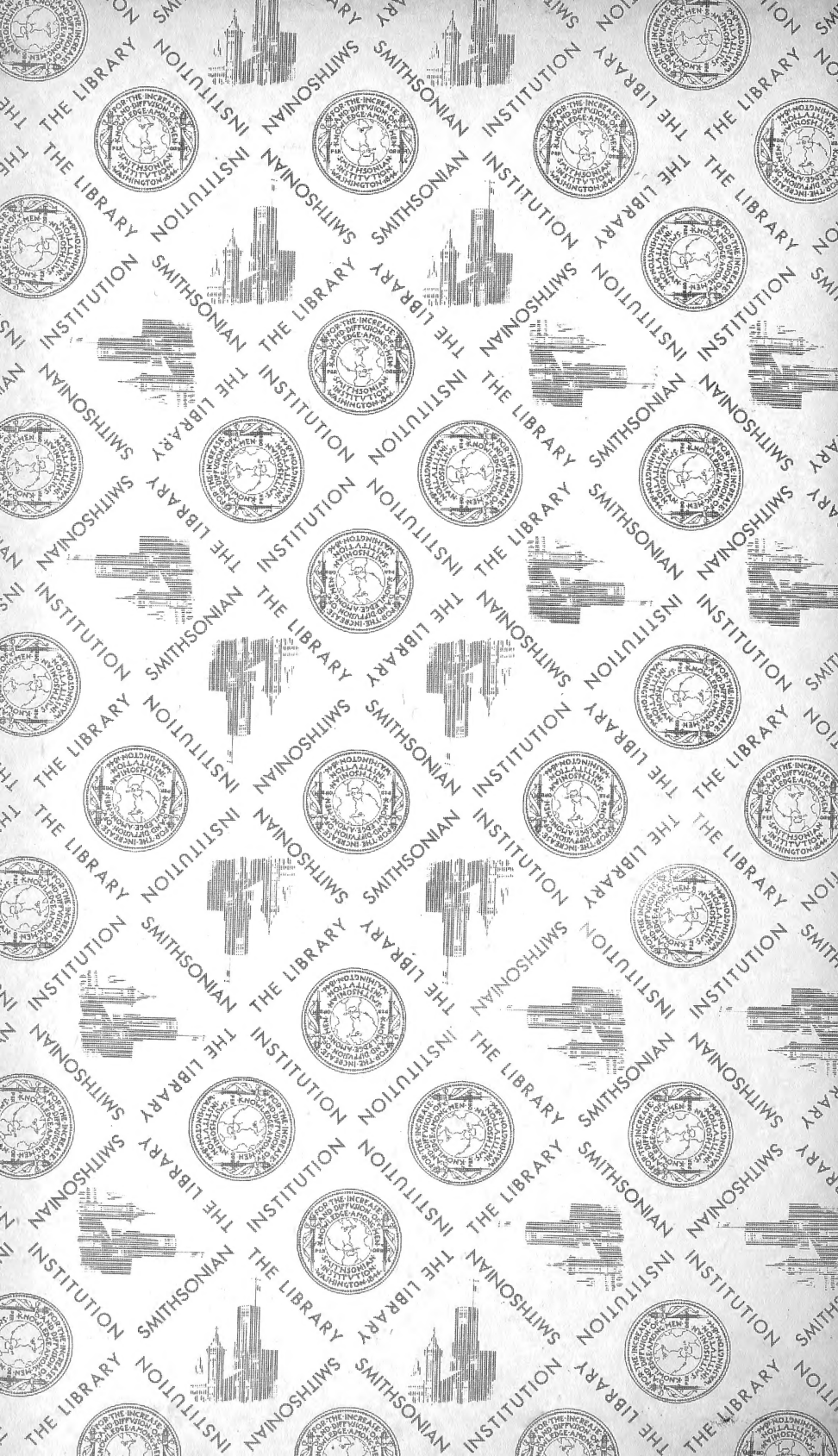
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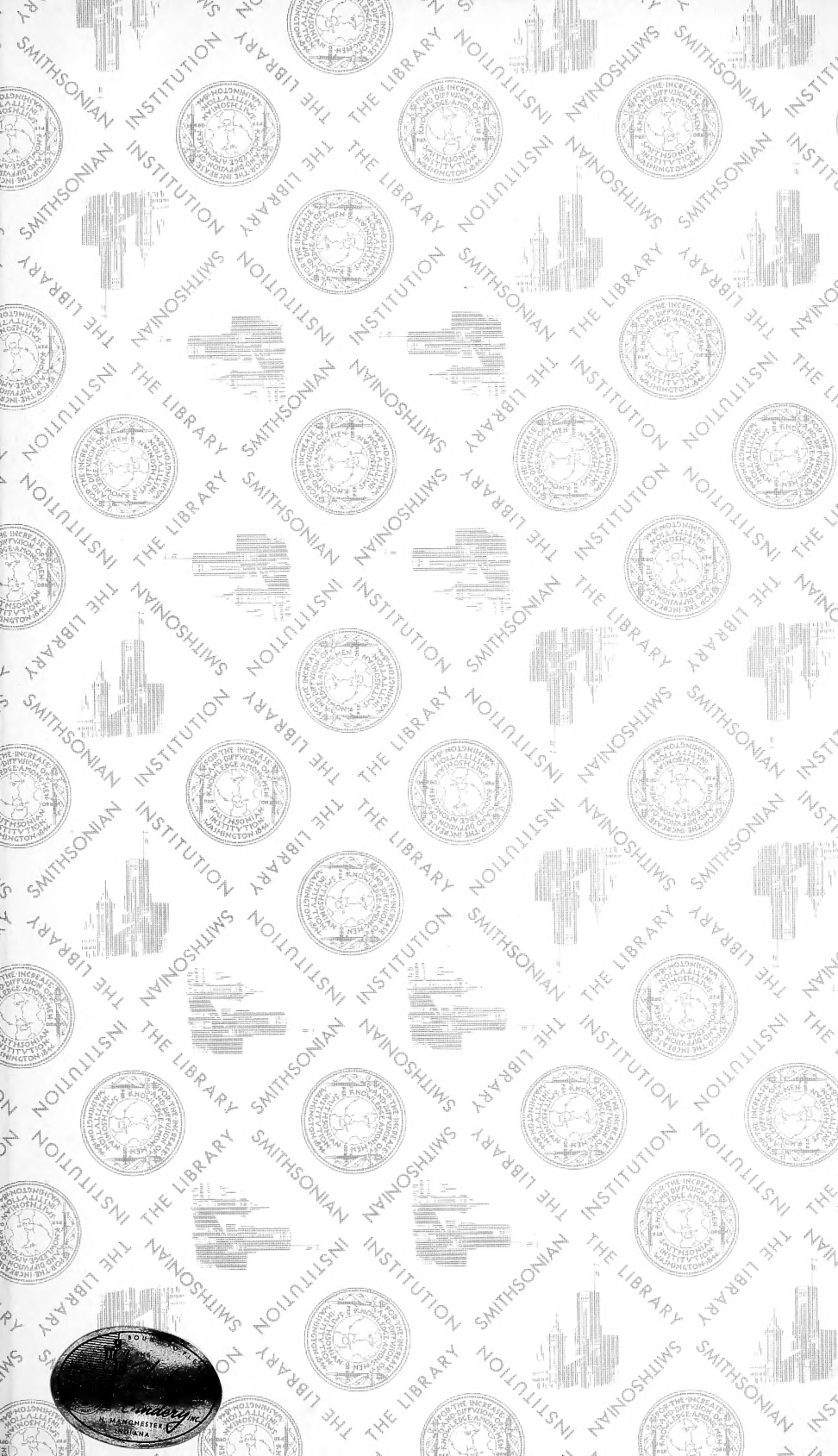
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